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FIRST ANNUAL REPORT
ON
THE NOXIOUS INSECTS
OF THE
PROVINCE OF ONTARIO.

PREPARED FOR THE AGRICULTURAL AND ARTS, AND FRUIT GROWERS'
ASSOCIATIONS OF ONTARIO, ON BEHALF OF THE ENTOMOLOGICAL
SOCIETY OF CANADA,

BY

THE REV. C. J. S. BETHUNE, M.A.,

*Head Master of Trinity College School, Port Hope; and Secretary-Treasurer of the Entomological
Society of Canada;*

WILLIAM SAUNDERS,

Vice-President of the Entomological Society of Canada; and

EDMUND BAYNES REED,

Secretary-Treasurer of the London Branch of the Entomological Society of Canada.

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INTRODUCTORY.

The following primary Report on some of the noxious insects of Canada has been prepared on behalf of the Entomological Society, for the Agricultural and Arts, and the Fruit Growers' Associations of Ontario.

In order to render this Report, and those that may follow it in future years, as valuable as possible, it has been deemed advisable to take up a few special fruits, vegetables or crops, and give a complete account of the insects affecting them, rather than to treat of a larger number in a less elaborate manner. The following pages include reports on insects affecting (1) the Apple, by the Rev. C. J. S. Bethune ; (2) the Grape, by Mr. W. Saunders ; (3) the Plum, by Mr. E. B. Reed ; each writer is responsible only for the statements contained in his own portion of the work. It is intended to treat of, next, the insects injurious to the wheat, potato, hop, and pea crops, the strawberry, currant and gooseberry, cucumber and squash, and cabbage ; and so to go on, if the work is continued and Providence permit, till the farmers, gardeners and fruit growers of this country are fully informed respecting the habits of their insect friends and foes, and the best modes of dealing with them.

As mere descriptions of insects are seldom intelligible to the general non-scientific reader, special pains have been taken to present an illustration of almost every insect referred to in the following Report ; and everyone will, no doubt, at once admit that any little value these pages may have, is greatly enhanced by the excellent wood-cuts that embellish them. Special thanks are due, and are hereby gratefully tendered, to the Honorable George Brown, for his kind loan of many beautiful illustrations from the *Canada Farmer*, and to Mr. C. V. Riley, the accomplished State Entomologist of Missouri, for permission to obtain electrotypes of many of his admirable drawings, which are certainly the best figures of the kind as yet produced in America. An acknowledgment also must by no means be omitted of the excellent wood-cuts specially produced for these pages by Mr. Beale, a rising artist of London, Ontario, and a member of the Entomological Society.

As these Reports have been prepared by persons who are much engaged in other occupations, and who only devote to the study of Entomology what little leisure they may be able to obtain, it is trusted that due indulgence will be accorded for any imperfections or omissions that may be apparent to the reader.

C. J. S. B.

Trinity College School, Port Hope,
December 12th, 1870.

INSECTS AFFECTING THE APPLE.

BY THE REV. C. J. S. BETHUNE, M.A

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| 1. The Apple-root Bark-louse (<i>Eriosoma pyri</i> , Fitch.) | 11. The Forest Tent Caterpillar (<i>C. sylvatica</i> , Harris.) |
| 2. The Two-striped Borer (<i>Saperda candida</i> , Say.) | 12. The White-marked Tussock Caterpillar (<i>Orygia leucostigma</i> , Sm. & Abbott.) |
| 3. The Buprestis Apple-tree Borer (<i>Chrysobothris femorata</i> , Fabr.) | 13. The Yellow-necked Apple-tree Caterpillar (<i>Datana ministra</i> , Drury.) |
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| 8. The Rose Beetle (<i>Macrodactylus subspinosus</i> , Fabr.) | 18. The Rascal Leaf-crumpler (<i>Phycita nebulo</i> , Walsh.) |
| 9. Cutworms (<i>Noctuidæ</i> .) | 19. The Codling-worm (<i>Carpocapsa pomonella</i> , Linn.) |
| 10. The Apple-tree Tent Caterpillar (<i>Clisiocampa Americana</i> , Harris.) | 20. The Apple Curculio (<i>Anthonomus quadrigibbus</i> , Say.) |

INSECTS INJURIOUS TO THE APPLE.

Of all the fruits grown in Canada, none can be compared in importance to the apple, whether we consider its almost numberless varieties, its universal distribution throughout the country, its excellence in beauty and flavor, its commercial value, or its beneficial effects upon the health of the community during our protracted winters; and yet none, probably, is more liable to suffer from the attacks of insects during every stage of its growth and in every part of its organization—root and branch, trunk, leaves and fruit, wood and bark, rind, flesh and core—in each and every part it has its peculiar insect foes. To these different enemies we purpose now to direct the reader's attention, describing briefly their several characteristics, that, with the aid of our illustrations, he may be able to identify the special pests of his own orchard, and, knowing who his enemies are, take measures for their effectual repression.

AFFECTING THE ROOT.

1. THE APPLE-ROOT PLANT-LOUSE (*Eriosoma* [*Pemphigus*] *pyri*, Fitch).—In many parts of the Western States, especially in Illinois, young apple-trees are affected by a disease in the roots, produced by the attacks of a woolly Plant-louse. This minute creature works under ground, and produces upon the roots, swellings and excrescences of all sorts of

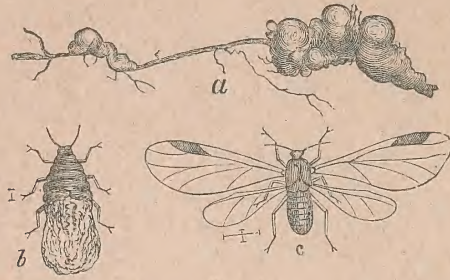


FIG. 1.

shapes and sizes; these interfere materially with the tree's supply of nourishment, and when very numerous occasion its death. Dr. Hull, of Alton, Ill., considers it "one of the worst enemies with which our apple-trees have to contend," and states that it is much more common than is generally supposed. In 1848 it was found so abundant in Chester county, Penn., that thousands of young trees had to be thrown away; and of late years it has been very injurious in many localities. It will be well, therefore, for Canadian fruit growers, and especially nurserymen, to be on the look-out for this creature, and whenever they find their trees less vigorous than they should be, and the leaves of a sickly appearance, they should examine the roots for the presence of this insect, provided there is no trace of borer or other obvious cause of disease. Though we have never heard of its working any mischief in Canada, it is yet as well that fruit growers should be warned of its existence, and be prepared to deal with it when they find it.

The Apple-root Plant-louse is a little over a tenth of an inch in length, including the closed wings, and of an opaque color; though so very minute it may be easily recognized by the peculiar bluish-white cottony matter which it exudes from its body, and which is never met with in the case of the common apple-tree plant-louse that inhabits the leaves and the tips of the twigs. The easiest mode of getting rid of it is to drench the infested roots with hot water, which, though hot enough to destroy the life of the insect, is not injurious to the vegetable organization. (*Amer. Ent.*, Jan. 1869.) In the case of young trees that are being transplanted, these insects may be destroyed by dipping the roots in strong soap suds or tobacco water.

AFFECTING THE TRUNK.

2. THE TWO-STRIPED BORER (*Saperda bivittata*, Say).—This insect and the species that follows are among the worst foes of the apple that we have in this country, their attacks are so insidious and the damage they inflict is so great; they both work in the wood of the trees, usually in the trunk, though the latter, as we have observed, occasionally in the branches also. The Two-striped Borer is only found in certain districts of the country, but it is to be feared that it will ere long spread throughout the length and breadth of it. It is very common in the Niagara district of this Province, and in many parts of the Province of Quebec, especially in the immediate neighborhood of the cities of Montreal and Quebec (*Couper, Can. Nat. vii.* 278); we have never met with it, however, on the north shore of Lake Ontario, nor has it been taken in the neighborhood of London, Ont. It is very destructive in many parts of the United States, attacking the quince, pear, mountain ash and hawthorn as well as the apple. Mr. Riley (*First Missouri Report*, p. 43) states that he has invariably found it more abundant in trees grow-

ing on high land than in those growing on low land, and that it is worse in ploughed orchards than in those which are seeded down to grass.



FIG. 2.

The accompanying figure represents the insect in its larva or grub state, and in its perfect condition as a winged beetle. The larva when full grown is about an inch in length, and less than a quarter of an inch in thickness. It is of a pale yellow or whitish color, with a brownish polished head, and deep black jaws; it is destitute of legs, but is enabled to move in its burrows by the contraction and expansion of its segments. The perfect insect is a pale brown beetle with two chalky-white longitudinal stripes running from the head to the apex of the wing-covers; the underside, legs and antennæ are also white. It makes its appearance in June and July, but is seldom seen, as it usually remains in concealment during the day, and flies only at night. The females deposit their eggs upon the bark of the tree near the base of the trunk, or collar as it is termed. From the eggs are soon hatched out tiny whitish grubs, which penetrate the bark and leave a hole so

minute that it soon closes up. For the first year the grub feeds only upon the sapwood, in which it excavates a round smooth cavity immediately beneath the bark, generally nearly filled, when opened, with the sawdust-like castings of the worm. These castings may very frequently be observed extruded from the burrow and on the ground at the base of the tree; whenever they are noticed search should at once be made for the borer within. As this borer does not occur in any part of Canada in which we have resided, we have had but little opportunity of investigating its habits, we therefore quote the following excellent account from our friend Mr. Beadle's Prize Essay on the Apple (*Fruit Growers' Report 1868, p. 172*): "When the grub has become about half-grown it ceases to cast the dust out of its cavity, and proceeds to fill it up, at the same time boring a passage or gallery upwards into the heart of the tree. This gallery is continued upwards, of varying length, sometimes not more than two inches, and sometimes twelve inches, and is gradually brought outwards again to the bark of the tree, but not through it. When the grub has completed this gallery, it turns round and returns to that part which is nearest to the heart of the tree; this part it now enlarges by tearing off the fibre from the walls, and with this fibre carefully and securely closes the entrance, so that if some insect enemy should find its way through the hole in the bark at the collar into the chamber where it passed the first part of its life, that enemy could not enter the gallery to its present abode. Meanwhile it crowds its sawdust-like castings into the upper extremity of the gallery against the bark, thus, at the same time, diminishing the danger of attack from that quarter, and keeping its chamber tidy. Having thus perfected its arrangements, it again turns round so as to have its head upward, passes the winter in a torpid state, and in the spring casts off its skin and becomes a pupa, from which in June the perfect insect hatches, climbs to the upper end of the gallery, tears away the fine sawdust, gnaws a hole through the bark and creeps forth." When several of these borers are at work in the same tree, their excavations approach each other so closely as often to girdle the tree and cause its destruction.

Many modes have been proposed for the destruction of this noxious insect, some of them essentially absurd, such as plugging up the holes in the trees which are made by the beetle when taking his departure from the scene of his early life, after he has finished his work of mischief. The simplest and most effectual remedies are: (1) the application of soap (cold made soft soap is especially recommended) to the trunk of the tree early in June and again in July; rub it well over, especially near the base of the trunk, and place a portion in the fork of the tree that it may be washed down into the crevices of the bark by the rains. (2) If the Borer has already taken up his abode in the tree, cut into his burrows with a sharp knife and get him out; his presence may generally be detected near the collar of the tree by the discoloration of the bark and by the sawdust castings. This is the most effectual, and by no means difficult remedy; much benefit, however, may also be derived from washing this part of the tree with lye, or any strong alkaline solution, which will penetrate the interstices of the bark and kill any young grubs that may be commencing to make their way inwards. The trees should be carefully examined—

especially if young and not long planted out—at different times during the year, as well as in the spring.

3. THE BUPRESTIS APPLE-TREE BORER (*Chrysobothris femorata*, Fabr.)—Though the apple-trees in many portions of Canada possess an immunity from the attacks of the Two-striped Borer, there are few, if any, localities where more or less damage is not inflicted by the Buprestis Borer, whose habits are very similar, and equally destructive. Like the preceding, it is the larva of a beetle, but of a totally different family; the former belongs to the long-horned beetles (*Cerambycidae*), distinguished by their long-jointed antennæ, while this is a Buprestian, belonging to a family (*Buprestidae*) whose members have very small and inconspicuous antennæ, and are remarkable for their

brilliant metallic colors. As may be seen in the accompanying illustrations, the grub of the former (Fig. 2) is thick and cylindrical, while that of the latter (Fig. 3) is flattened, and especially distinguished by the broadness of the fore part of its body. The parent insect is represented at the right hand side of the illustration (Fig. 3). By bearing these figures in mind, the reader will find no difficulty in distinguishing the one pest from the other, should he be unfor-



FIG. 3.

tunate enough to be troubled with either of them.

The natural history of the Buprestis Borer may be briefly related as follows:—The egg is deposited by the female beetle in the chinks and crevices of the bark some time during the early part of summer; from this the young grub soon hatches, and works his way into the soft sap-wood immediately beneath. Here he eats away, while the cavity inside becomes larger and larger, and he increases in size himself, gradually working upwards until he becomes pretty well grown, when he bores into the solid heart of the wood, and forms a flattish burrow, corresponding to his own flat form. Some assert that this borer never leaves the sap-wood, to go into the harder interior; but we have several times cut them out of the very centre of the trunk of a young apple-tree, while others were at work nearer the surface. When several attack the same tree, as they generally do, their burrows, of course, approach very near each other, and oftentimes so practically girdle it as to cause its speedy death; in any case, they very much injure its vitality, and bring on decay. We know, indeed, of two young orchards, where more than half of the trees have been greatly injured by this insect, while some were killed outright; and we have heard of a number of others that were similarly affected. In the spring of the year the grub assumes its pupa or quiescent state, and comes out as a perfect beetle in the end of June, or during July, when—unlike the previous species, which loves concealment—it may be found basking on the tree-trunks in the hot sunshine. It is very lively when danger threatens, and will take wing in an instant if an attempt be made to catch it. Its blackish-brown color, and rough surface above, so much resemble the bark of the tree, that it would easily escape the notice of ordinary observers; but beneath it is of a beautifully burnished dark copper color, looking as if made of metal, and under the wing-covers it is bluish green. The Two-striped Borer attacks the tree, as a rule, only near the root, though occasionally at the fork above; the Buprestis Borer is not so particular as to his locality, but attacks the whole trunk, and sometimes the limbs. They both prefer young trees, probably because the bark is thinner, and more easily penetrated by the young grub.

The presence of the grub in the tree may be detected by the discoloration of the bark, and its flattened, dried appearance. All such spots should be opened with a knife, and the inmate ruthlessly butchered on the spot. In young orchards all the trees should be carefully examined two or three times during the year, especially in early spring, and in the autumn, and all affected ones be promptly treated with an application of the knife. This, however, is a somewhat slow and tedious process; it is much easier to prevent the attacks of the insect than to get rid of him when he has once effected a lodgment. An excellent mode of doing this is by the application of soap, as recommended above in the case of the Two-striped Borer, only remembering that the whole trunk is liable to attack, and must therefore be soaped, and not merely the portion above the collar. Mr. Riley states (1st Missouri Report, p. 47) that "it attacks not only the apple, but the soft maple, oak, peach, and is said to attack a variety of other forest trees; though, since the larvæ of the family to which it belongs all bear a striking resemblance to each other, it

is possible that this particular species has been accused of more than it deserves." Dr. Fitch states that the natural food-plant of this borer is the white oak, and that the destruction of the forests caused it to make use of the apple and peach; this, however, is probably a mistake arising from the similarity of the larvæ of different species.

Man's efforts for the extermination of this borer are greatly aided by the labors of several species of Woodpeckers, which tap over the surface of the trees, and, detecting the presence of the grub by the hollow sound, soon open out his burrow, and draw out the rascal with their long, sharp-pointed tongue. The vulgar name of Sap-suckers applied to these birds should be discountenanced as much as possible, for they are physically incapable of sucking out the sap of trees, the structure of their beak and tongue being especially adapted for the procurement of their natural food, borers and other insects, as may be seen from the accompanying illustration.

On this subject we cannot refrain from quoting the remarks of the celebrated Ornithologist, Wilson, the truth of which we have frequently verified:—"Of all our Woodpeckers, none rid the apple trees of so many vermin as this (the Downy Woodpecker, *Picus pubescens*, Linn.), digging off the moss which the negligence of the proprietor had suffered to accumulate, and probing every crevice. In fact, the orchard is his favorite resort in all seasons, and his industry is unequalled and almost incessant. In the fall he is particularly fond of boring the apple trees for insects, digging a circular hole through the bark, just sufficient to admit his bill; after that a second, third, etc., in pretty regular horizontal circles round the body of the tree; these parallel circles of holes are often not more than an inch or an inch and a half apart. From nearly the surface of the ground up to the first fork, and sometimes far beyond it, the whole bark of many apple trees is perforated in this way, so as to appear as if made by successive discharges of buck-shot, and our little Woodpecker is the principal perpetrator of this supposed mischief; I say supposed, for, so far from these perforations of the bark being ruinous, they are not only harmless, but, I have good reason to believe, really beneficial to the health and fertility of the tree. In more than fifty orchards which I have myself carefully examined, those trees which were marked by the Woodpecker (for some trees they never touch, perhaps because not penetrated by insects) were uniformly the most thriving, and seemingly the most productive. Many of these were upwards of sixty years old, their trunks completely covered with holes, while the branches were broad, luxuriant and loaded with fruit. The most common opinion is, that they bore the tree to suck the sap, and so destroy its vegetation, though pine and other resinous trees, on the juices of which it is not pretended they feed, are often found equally perforated. Besides, the early part of spring is the season when the sap flows most abundantly, whereas, it is only during the months of September, October and November that Woodpeckers are seen so indefatigably engaged in orchards, probing every crack and crevice, boring through the bark, and, what is worth remarking, chiefly on the south and southwest sides of the tree, for the eggs and larvæ deposited there by the countless swarms of summer insects. Here, then, is a whole species, I may say genus, of birds, which Providence seems to have formed for the protection of our fruit and forest trees from the ravages of vermin, which every day destroy millions of those noxious insects that would otherwise blast the hopes of the husbandman; and yet they are proscribed by those who ought to have been their protectors, and incitements and rewards are held out for their destruction." In some parts of the Western States, it is said that great damage is done to orchards by the Yellow-bellied Woodpecker (*S. varius*, Baird), but Dr. Bryant (*Proc. Boston Soc. Nat. His.*, x, 91) states that he examined the stomachs of six specimens forwarded from Wisconsin, in all of which were found portions of the inner bark of the apple tree, but they also contained a much greater quantity of insects; "in one bird there were two larvæ of a boring beetle, so large that there was not room for both in the stomach at once, and one remained in the lower part of the œsophagus. If these were the larvæ of the Saperda, as is probable, they would do more damage than twenty Woodpeckers, and I sincerely hope that these birds are not to be exterminated, unless it is clearly demonstrated that the injury caused by the destruction of the bark is not more than compensated by their destruction of noxious insects."



FIG. 4.

AFFECTING THE BRANCHES.



FIG. 5.

4. THE OYSTER-SHELL BARK-LOUSE (*Aspidiotus conchiformis* Gmélín).—Although there are two species of Bark-lice that affect the apple in the northern United States, there is only one, so far as we are aware, that is injurious in Canada. The other, which is called Harris's Bark-louse (*A. Harrisii*, Walsh,) is often very destructive in Pennsylvania, Maryland, South Illinois and Missouri, and is occasionally met with further north. We are not very likely to be troubled with it in this country, but yet it is well that we should know the difference between it and the other more common species. "The color of the scale is dirty white, and its form is irregular, being usually egg-shaped; but however variable in outline, it is always quite flat and causes the infested tree to wear the appearance shown in the accompanying wood-cut (Fig. 5); while the minute eggs which are found under it in winter time are invariably blood-red or lake red."—(Riley.)

The other species, which infests our apple-trees in all parts of the Dominion, is named the Oyster-shell Bark-louse (*A. conchiformis*, Gmélín), from the shape of the scale, which is always like that of the oyster-shell; it is of an ashen-gray color, the same hue as that of the bark, and in winter and early spring covers a number of white eggs—not red as in the preceding species. The shape of the scale and the color of the eggs form ready and apparent distinctions between the two species, so that there is no danger of mistaking them. A comparison of Fig. 6, which represents a twig covered with the Oyster-shell Bark-louse, with Fig. 5, representing the other species, will show the reader the distinction more satisfactorily than any words of ours. Our Canadian species (which, by the way, like so many others of our most injurious insects, is an importation from Europe,) passes its life in the following manner:—About the end of August or beginning of September the mother insect lays a quantity of very minute eggs beneath a scale that she has already formed in some, as yet, unaccountable way; some entomologists incorrectly say that this scale is the body of the gravid female covering and protecting the eggs; others, with more probability, that it is an exudation from her body. Having completed this work, she dies; but the eggs remain under the scale, which, as we have seen, very much resembles an oyster-shell in shape, all through the winter until the following spring. About the first week in June, or later, according to the season, the eggs hatch and produce a number of excessively small plant-lice (Fig. 7-2) which, on the first subsequent hot day, leave the protection of the scale, and spread over the branches of the tree, attacking especially the soft terminal twigs. For a few days they possess the power of moving about, but after they once select a spot on the tree and begin to suck the sap there, they never move again, but remain as stationary and as much fixtures as if they



FIG. 6.

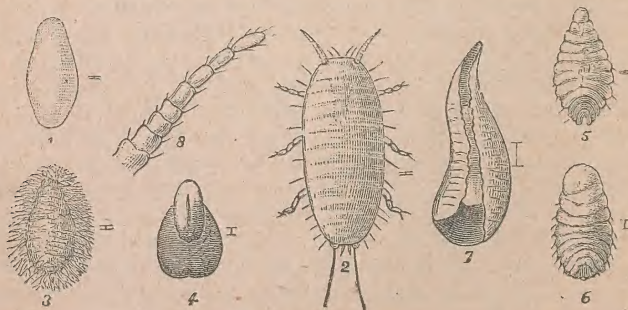


FIG. 7.

were twigs themselves. After a time each one becomes covered with a white waxy secretion, that issues from the body in the shape of very fine delicate threads (Fig. 7-3). This

secretion disappears after a few days, and leaves the creature covered with a pale brown scale; in about a week's time a fresh secretion arises from the posterior end, and assumes an oval form, giving the creature the form represented in Fig. 7-4.* After another ten days or a fortnight another plate is secreted, larger than the two others together; and at the end of July or beginning of August, its whole growth appears to be completed; and on lifting up the scale, thus formed in three successive portions, but now united into one (Fig. 7-7), the louse may be seen snugly ensconced and protected from the world without. Here in due time it lays its eggs, and finally dies; leaving the seed of another generation to take its place. We have thus far been describing the female insect, but we have no description to give of the male for the simple reason that no male has as yet been ever discovered. Judging from analogy, he is probably furnished with wings, but his intervention, as in the case of the Aphides, is perhaps not required for many successive generations, if, indeed, the whole race be not hermaphrodite, that is, consisting of but one sex which unites the functions of both.

Such being the history of this insect, it is plain, and it has been proved by experiment, that the only time to successfully apply remedies for it is during the short period that intervenes between the emergence of the young insect and the formation of its new scale. It can then be destroyed by rubbing the affected branches with a stiff brush, or by washing them with a strong solution of soap; but these remedies are of but little use except at that particular time, namely, early in June, as it is difficult to make a solution penetrate the scale, and so destroy the creature beneath. Much, however, can be done by scraping off the scales from the limbs of the trees in spring, or indeed, at any time of the year. In setting out a new orchard great care should be exercised in the inspection of the young trees; by then getting rid of all the scales that may be found attached to a tree, its future immunity from this pest, may be, as a rule, relied upon. Mr. Beadle, in his Prize Essay already referred to (p. 173), states that "the best remedy for these insects seems to be a sort of paint, made by boiling leaf tobacco in strong lye, until it becomes an impalpable pulp, and then mixing it with cold-made soft-soap (which is ropy, not the jelly-like soap), until it is about as thick as paint is usually applied; with a paint brush apply it to all parts of the tree where these Bark-lice are found, before the buds swell in the spring. If this be carefully and thoroughly done, the bark-lice will be surely killed, and the tree will make a thrifty growth." In the *Canada Farmer* for August, 1869, (p. 296), Mr. J. Glover, of St. Thomas, relates how he saved two apple-trees from destruction by bark-lice by dashing over them early in the winter, a quantity of lye that remained after soap-making. We may quote our remarks upon his letter:—"Strong alkaline solutions are always considered the best remedy for these and similar pests, but a difficulty in applying them is that, when strong enough to destroy insect life, they are apt to destroy vegetable life as well. By using lye, however, when there are no leaves or opening buds to be injured, good appears to be effected. The reason we limit the application of a solution of soap to the short period during which the bark-lice are unprotected by their usual scale, is because it is so difficult to get any solution that will penetrate the hard scale, and reach the eggs that are under it in winter, and the louse in summer."

Although artificial remedies are thus few in number, and not very satisfactory in application, nature—happily for the fruit-grower—furnishes us with much better ones, that require no trouble on our part, except the performance of the negative duty of letting them alone. One of these is a very minute mite (*Acarus*), that devours immense quantities of the eggs and young of the Bark-louse. Another consists of the many varieties of Lady-birds (or Lady-bugs, as they are often improperly and unpleasantly termed), especially one called the Twice-wounded Lady-bird (*Chilocorus bivulnerus*, Muls.). This useful insect is of a deep, shining black color, with a blood-red spot (whence its name) on each wing-cover,

*These figures (from Riley's 1st Rep. Miss.) are highly magnified, the hair lines at the sides show the natural sizes. 1. Egg; its natural size is scarcely the one-hundredth part of an inch. 2. Larva, as it appears when running over the twigs; natural size 1-100 inch. 3. Its appearance after becoming stationary. 4. Appearance of the scale after the second secretion takes place. 5. Form of the louse (ventral view) after losing its members. 6. Form of the louse (ventral view) when full grown and just about to deposit. 7. Fully-formed louse, as it appears from the under side, when raised. 8. Highly-magnified antenna of larva, showing the joints.

and is about the size and shape of a split pea. It is represented, magnified, in Fig. 8, the hair-line at the side showing the natural size. Fig. 9 represents its larva, which is a dark grey prickly creature, extremely active and voracious in its habits. Its pupa may often be found on the trunks of all sorts of trees, partly covered and surrounded by the prickly larva-skin. This fruit-growers' friend, and all the other species of Lady-birds (*Coccinellidae*), should never be destroyed, but always cherished and protected to the utmost.



FIG. 8.



FIG. 9.

5. THE APPLE-TREE PRUNER (*Stenocerus putator*, Peck ; *S. villosus*, Fab.).—At a meeting of the Fruit Growers' Association of Ontario, held at St. Catharines in July, 1866, a portion of an apple-tree branch, that had been cut off by some insect, was exhibited by Mr. Charles Arnold, of Paris, Ont. After the meeting, the specimen was forwarded to us for examination. We found, upon cutting into the branch, which had been neatly severed by some insect, that the culprit was a long, cylindrical grub, who was quietly concealed in his burrow, from which he had evidently no expectation of emerging into daylight till ready to issue forth as a perfect beetle. From the appearance of the grub, as well as of the burrow, we were led to believe the insect to be a specimen of the Pruner Stag-beetle (*Stenocerus putator*, Peck), which has for some time been known to attack oak trees, and which, Dr. Fitch (3rd Rep., N. Y., p. 12,) states, occasionally affects apple-trees also.



FIG. 10.



FIG. 11.



FIG. 12.

The larva, or grub (Fig. 11), of the apple-tree Pruner is a little over half an inch in length when full grown, and about a seventh of an inch in breadth across the neck, which is its thickest part, and from which it tapers gradually backwards. The head is small and black, the neck and remaining segments of the body, yellowish white, with some slight blackish markings. The segments, or rings, are thirteen in number (including the head), as is usual amongst all larvæ, but the last two are frequently concealed in the one before them, the insect apparently assisting its progression by drawing them in and out. It has six very minute legs, attached to the anterior segments. From this larval state, it turns into a somewhat active pupa (Fig. 12) in the spring of the year, and completes its final transformation into a beetle in the month of June. It is then a cylindrical beetle (Fig. 10), of a dull black color, with brownish wing-covers; the antennæ in the male are longer than the body, and in the female, equal to it. The whole body is covered with short, close gray hairs, which, from being denser in some places than in others, form spots on the thorax and elytra; its total length varies from half an inch to three-fifths. The above illustrations represent the female beetle (Fig. 10); the larva, magnified (Fig. 11); and the pupa, enclosed in its burrow, also magnified (Fig. 12).

The particular habits and instincts of this insect render it one of the most curious and interesting that we have. The following is an account of them, that we gave in the *Canada Farmer* at the time above referred to: The parent beetle, with a view to provide soft and easily masticated food for the tender jaws of the infant grub, lays its eggs in the green, fresh growth of a twig proceeding from a moderate sized limb. The young worm, immediately upon its exit from the egg, burrows down into the centre of the twig, and consumes all the soft, pulpy matter of which it is composed. By the time it reaches the main branch, it has become sufficiently matured to be able to feed upon the strong meat of the hardwood, and accordingly makes its way into the branch, leaving the hollowed twig to gradually wither and drop off. It now eats its way downward a short distance (half an inch in the specimen before us), through the middle of the branch, and proceeds deliberately to cut off its connection with the tree, and make its way to the earth by the shortest pos-

sible route. This, however, is a rather delicate operation, and requires the exertion of all the insect's wonderful instinctive skill; for were it to gnaw too much of the wood away, the branch would break during the proceeding, and probably crush the workman to death. But with admirable forethought and precision, it leaves the bark and just enough woody fibres untouched to sustain the branch until it has time to make good its retreat into its burrow, the opening of which it carefully stops up with gnawed fragments of wood. "But," as Dr. Fitch relates "the most astonishing part of this feat remains to be noticed. The limb which he cuts off is sometimes only a foot in length, and is consequently quite light; sometimes ten feet long, laden with leaves, and quite heavy. A man, by carefully inspecting the length of the limb, the size of the branches, and the amount of the foliage growing upon them, could judge how far it should be severed to insure its being afterwards broken by the winds. But this worm is imprisoned in a dark cell, only an inch or two long, in the interior of the limb. How is it possible for this creature, therefore, to know the weight and length of the limb, and how far it should be cut asunder? A man, moreover, on cutting a number of limbs of different lengths so far that they will be broken by the winds, will find that he has often miscalculated, and that several of the limbs do not break off as he designed they should. This little worm, however, never makes a mistake of this kind. If the limb be short, it severs all the woody fibres, leaving it hanging only by the bark; if it be longer, a few of the woody fibres on the upper side are left uncut, in addition to the bark. If it be very long and heavy, not more than three-fourths of the wood will be severed. With such consummate skill does this philosophical little carpenter vary his proceedings to meet the circumstances of his situation in each particular case!"

Having performed this operation carefully, and closed its hole, that the jarring of the branch when it falls to the ground may not shake it out, the grub retreats to where it first entered the limb, and goes on eating up through the heart for about six inches or a foot, and this it does both before and after the branch reaches the ground. The object of this amputating process it is difficult for us to understand fully, but we may imagine that it is for two purposes: first, as regards the insect itself, that it may the more effectually escape the attacks of woodpeckers and other foes, and be less exposed to the winter frosts; secondly, that the tree may receive the benefit of a pruning of its growth, which in its natural state might be too exuberant. Thus wonderful and varied are the checks and counter-checks that the Almighty imposes upon his works; to each one there is laid down the law, "Thus far shalt thou go, and no further!"

The obvious remedy for these singular insects, when they attack fruit or other valuable trees, is to gather up the fallen limbs and burn them, before the grub has time to complete his transformation into the perfect state.

6. THE APPLE TWIG-BORER (*Bostrichus bicaudatus*, Say).—Besides the above mentioned insects, the branches, or rather twigs, of the apple-tree have as a foe a small cylindrical beetle called the Twig-borer. It is frequently injurious in Illinois, Missouri and other States, but has not yet made its appearance in Canada; we shall therefore dismiss it in a few words. "It preys upon the twigs of good sized trees, boring in just above a bud, and working downwards through the pith in a cylindrical burrow for the space of one or two inches. The male is distinguished from the female by having two little thorns projecting from the hind end of its body, and both males and females are found in these burrows, and always with their heads downwards, showing that they bore the hole, not in the larva state like other borers, but in the perfect beetle state. Neither can they bore these holes as a breeding place for their future larvæ; for no larvæ have ever been found therein. Evidently, therefore, they must bore them as a means of supplying themselves with food."—(*Am. Ent.*, 1, 206.) Dr. Fitch states that this insect occurs from Pennsylvania to Mississippi, and has been common of late years in the orchards of Michigan and Illinois; we must not be surprised, then, to find it some day in the western parts of Ontario. Mr. Zimmerman, of Cameron, Mo., states that they work during the months of August, September and October, on both pear, cherry, and apple-trees; and that he has found sometimes as many as ten twig-borers on a single two or three year old tree. The twigs thus injured usually break off with the wind.

AFFECTING THE LEAVES.

7. THE APPLE-TREE PLANT-LOUSE (*Aphis Mali*, Fabr).—Every one who cultivates a single foot of land, or even grows a house-plant in a pot, must know what a Plant-louse is like, for they are to be found at one time or another, we may safely say, upon every kind of ordinary plant that exists in this country. The good wife who tends with anxious care her geranium or fuchsia in the cottage window, knows full well how mysteriously the little green pests come back on her plants, in spite of frequent washings with soap-suds or smokings with the old man's pipe; the gardener knows how the same minute creatures suck the juices of the majority of his vegetables and plants, and what a very plague they oftentimes are in the conservatory; and the fruit grower must assuredly have noticed the curled up leaves of his currant-bushes all alive beneath with a loathsome mass of these insects, or the blackened tips of the young shoots of his apple-trees, whose shrivelled leaves swarm on the underside with myriads of tiny greenish lice. But few, perhaps, can tell why it is that they are so numerous, and appear in such thousands on a plant that a few days before seemed perfectly free from their attack. The reason is because they are so astonishingly productive. From a single female plant-louse, of an ordinary species, Mr. Curtis has calculated that there may be produced in seven generations the tremendous number of 720 millions of descendants, each one of whom possesses a similar fecundity. In the case of the grain-louse, Dr. Fitch states that "a single one produces four daily, and these become equally prolific when they are three days old; thus her descendants in twenty days will number upwards of two millions, and will increase at the rate of a million daily!" No wonder, then, that they appear as if by magic where none were noticed before.

The aphid or plant-louse of the apple belongs to the same order of insects (*Homoptera*) as the bark-louse that we have already considered. Early in the spring, as soon as the buds begin to expand, this tiny insect, with multitudes of its fellows, emerges from the almost microscopically minute egg that has remained all winter in some crevice of the bark. It at once attaches itself to some tender leaf, bud or stem, and there employs its life in sucking out the juices of the tree. It is of a pale greenish colour, and somewhat

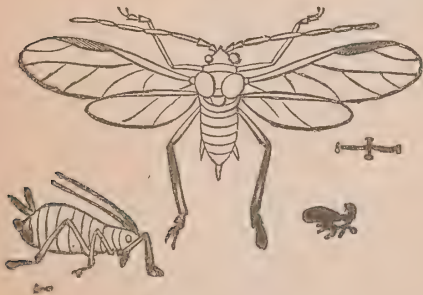


FIG. 13.

less than a tenth of an inch in length. The accompanying illustration (fig. 13) of a greatly magnified winged male and wingless female, shows the structure and shape of the insect; its beak, which proceeds from the under side of the head, is here hidden from the view in the male but can be seen in the female. Strange as it may appear, all the plant-lice hatched from the eggs are females, and these in less than a fortnight arrive at maturity, and commence giving birth to living young, which are also females. Every day, during its brief life of about a month, it produces two or three young ones, which in their turn arrive at maturity and in-

crease the population in the same ratio. As long as the summer lasts no males are produced, the original fecundation of the females in the eggs apparently sufficing for the numerous generations that follow; late in the autumn, however, winged males are born, and these, uniting with the females, become the parents of the eggs for the following year. Their natural history is thus most strange, and contrary to all experience in other orders of insects.

Almost all the different species of plant-lice secrete a sweetish fluid called honey-dew, which is ejected from the two projecting horns, or nectaries, on each side of the abdomen behind. This fluid, when it falls upon the leaves and branches beneath a colony of these insects, evaporates and forms a sweet glutinous substance upon which many insects are fond of feeding. The ants particularly are fond of this sweetness, and not content with obtaining it as it is discharged by the aphid, they actually perform an operation upon the plant-louse, very much resembling the process of milking a cow, and cause it to discharge its sweetness for their own particular benefit.

The enormous number of these plant-lice upon the apple, and their wonderful powers of reproduction, cause them oftentimes to inflict very great damage upon an orchard. In such cases it is desirable to apply a remedy if practicable. The most highly recommended remedies are: (1) Dusting the affected leaves with lime or sulphur; (2) watering them from beneath with strong soap-suds by means of a syringe or garden engine; and (3) a similar application of a strong decoction of tobacco, one pound of stems and rough

leaf being boiled in a gallon of water. The best of all remedies are, however, provided by the good Providence of the Creator, and consist of small parasitic insects which prey upon the plant-lice. The most common of these are the various species of lady-birds, both in their larval and beetle states [fig. 14 represents these two conditions of a common species, the nine-dotted lady-bird (*Coccinella novem-*



FIG. 14.

notata.)] The lace-winged or golden-eyed flies (*Chrysopa*), fig. 15, so called from some of their most striking characteristics. These flies have four delicate, transparent, white wings, like bits of fine lace, bright golden eyes, and a lovely green body; but though so pretty to look at, most horrible to handle, the odor they emit being of the most sickening and offensive character. Their larva (fig. 16) is equally destructive to aphides with the fly itself; the eggs curiously placed upon stalks are represented on the right in fig. 16. Yet another friend to man and enemy to plant-lice is depicted in



FIG. 15.

fig. 17; the larva of the *Syrphus* fly, which is a two-winged insect of various colors, oftentimes resembling a wasp or hornet. Other enemies to the Aphides that may be mentioned, are dragon flies, ichneumons, etc. But for the assistance rendered by these useful insects, the plant-lice would speedily increase to such an extent as to sweep away all vegetation from the face of the earth.

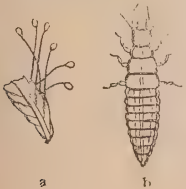


FIG. 16.



FIG. 17.

8. THE ROSE BEETLE (*Macrodactylus subspinosus*, Fabr).—Among the insects injurious to the apple in this country, Mr. Beadle includes the Rose-beetle (or “bug” as it is commonly termed); Dr. Fitch also enumerates it amongst apple-tree insects in his New York Reports. Our own acquaintance with it has, happily, been so slight, and its tastes are so omnivorous where it does occur, that we should have been inclined to place it in some other category, as for instance, under the grape insects, and leave it to our friend Mr. Saunders to deal with in his portion of this report. As it is, however, oftentimes very destructive to the leaves of the apple where it does occur, it will be well for us to give a short description of it here.

The Rose-beetle is slender in form, tapering a little towards each end, and about two-fifths of an inch in length. Its general color is yellowish, fresh specimens being covered with a dull ochre-yellow down or bloom; when this is rubbed off, the head, thorax and under side of the body appear shining black, the wing-covers brownish-yellow, and the legs reddish-yellow. These last mentioned appendages are long and slender, and furnished with excessively long spinous feet or claws, from which peculiarity the insect derives its scientific name. Towards the end of June these beetles appear, where they occur at all, in vast numbers and continue to devour almost everything of a vegetable character that comes before them for about a month or six weeks, and then they entirely disappear till another summer comes round with a fresh horde. Before their disappearance, the females lay about thirty eggs an inch or so below the surface of the earth and these hatch out in about three weeks. The young grubs feed upon any tender roots within reach, and attain their full size before winter sets in, when they are about three-fourths of an inch long and an eighth broad, of a yellowish-white color, with a darker head. When the autumnal frosts set in, they descend some distance into the earth to escape the danger of freezing and thawing in the winter, but on the arrival of spring they come towards the surface

again, and there form an earthen cell in which to pass the pupa state. This lasts about a month, and then they come forth as perfect beetles to do all the mischief they can during their short existence. Their whole life, in all its stages, thus lasts but a year—a period far too long, however, in the opinion of those who are so unfortunate as to be afflicted by them.

The only locality, where we have seen these creatures at work, is the garden at the Parsonage, Oakville; there they came in vast numbers and devoured everything—nothing appeared to come amiss to them; they were especially destructive, however, to the grape-vines. As they seem to be proof against all the ordinary remedies for injurious insects, the only method is to set to work and catch and kill them. This is easily done, as their habits are rather sluggish; a few children could soon gather thousands and speedily diminish their numbers. Much might also be effected by jarring the trees that they are on, in the cool of the morning or evening, when they are less active, and adopting the same measures that are efficacious in the instance of the Plum Curculio.

CATERPILLARS AFFECTING THE LEAVES.

9. CUT-WORMS (*Noctuidæ*).—Fruit-growers have long observed that the buds of their trees in early spring are oftentimes eaten off and destroyed by they know not what. The mischief was attributed sometimes to birds, sometimes to winged insects or slugs, and even to late frosts; but it was not until a few years ago that the discovery was made that it was all to be ascribed to the depredations of cut-worms. As Mr. Riley has demonstrated, many species of cut-worms are very destructive to fruit trees, especially the dwarf varieties. In the spring before the leaves are expanded, these worms climb the trees at night and eat off the fruit buds, devouring the ordinary leaf buds when there are no more of the others left. At break of day they drop from the trees, and conceal themselves in the earth till night comes round again. They are more injurious on sandy soil than on clay, as the former is softer to drop upon, and more easily penetrated for concealment.

In the *Prairie Farmer* (June, 1866), Mr. Cochran, on whose farm these facts were first observed, gives the following interesting account of the proceedings of these cut-worms:—

“They destroy low branched fruit-trees of all kinds except the peach, feeding on the fruit buds first, the wood buds as a second choice, and preferring them to all other things, tender grape-buds and shoots (to which they are also partial) not excepted—the miller always preferring to lay her eggs near the hill or mound over the roots of the trees in the orchard; and if, as is many times the case, the trees have a spring dressing of lime or ashes with the view of preventing the May beetle's operations this will be selected with unerring instinct by the miller, thus giving her larvæ a fine warm bed to cover themselves up in during the day from the observation of their enemies. They will leave potatoes, peas, and all other young green things for the buds of the apple and the pear. The long, naked young trees of the orchard are almost exempt from their voracious attacks, but I have found them about midnight, of a dark and damp night well up in the limbs of these. The habit of the dwarf apple and pear tree however just suits their nature, and much of the complaint of those people who cannot make these trees thrive on a sandy soil has its source and foundation here, though apparently utterly unknown to the orchardist. There is no known remedy; salt has no properties repulsive to them, they burrow in it equally as quick as in lime or ashes. Tobacco, soap and other diluted washes do not even provoke them: but a tin tube 6 inches in length opened on one side and closed around the base of the tree, fitting close and entering at the lower end an inch into the earth, is what the lawyers would term an effectual estopper to further proceedings.

If the dwarf tree branches so low from the ground as not to leave 6 inches clear of trunk between the limbs and ground, the limbs must be sacrificed to save the tree—as in two nights four or five of these pests will fully and effectually strip a four or five year old dwarf of every fruit and wood bud, and often when the tree is green utterly denude it of its foliage. I look upon them as an enemy to the orchard more fatal than the

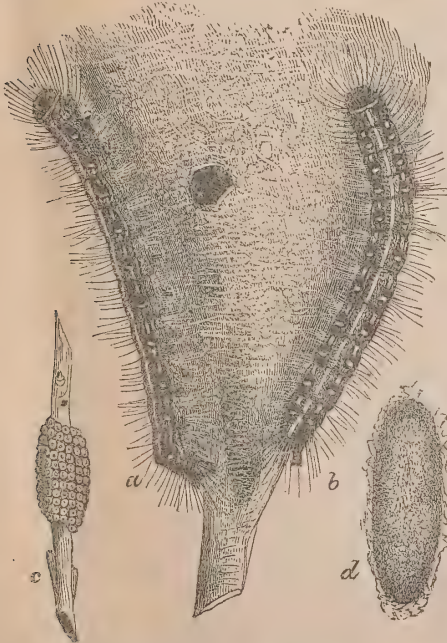
canker-worm when left to themselves, but, fortunately for mankind, more easily headed off."

Out worms, as most of our readers are, no doubt, well aware, are those dirty, greasy-looking caterpillars that are such a plague to gardeners in spring and early summer, from their habit of cutting off at night close to the surface of the ground, the young cauliflower, cabbage and tomato plants, early peas, many flowers, such as stocks, balsams, etc., and, in fact, almost any tender young plant. There are a large number of species of these insects, all pretty much alike in their larval or caterpillar state. They turn into those common, dull brown and greyish moths that are so numerous in summer evenings about one's lamp or candle, and which may often be found hiding in the morning about the shutters or in the crevices of the windows. The plan recommended above, in Mr. Cochran's observations, is probably the simplest and most efficacious for keeping them off our apple and other fruit trees; much might be done also by jarring off and destroying the worms at night. Any one desiring full particulars, with descriptions, of these insects and the moths into which they turn, will find an elaborate account in Mr. Riley's *First Report on the Noxious Insects of Missouri*.

10 and 11. TENT CATERPILLARS.—(*Clisiocampa Americana*, Harris, and *C. Sylvatica*, Harris.) Though we are enumerating a large number of insects injurious to the apple-tree in their respective ways, there are four kinds that stand out above all the rest in the extent of their ravages and in the wideness of their distribution. These are the two borers in the trunk; the bark lice on the branches; the tent caterpillars, which we have now come to, on the leaves; and the codling-worms in the fruit. Of these four kinds of insects, the Tent caterpillars are the most conspicuous in their work of destruction, and probably the best known to people in general. They belong to two different species, called the American and the Forest Tent-caterpillars; the former especially attacks the apple, though occasionally it is found upon plum, cherry and pear trees, and more frequently upon the wild cherry; the latter, as its name implies, is more addicted to the foliage of forest trees, but of late years it has proved very injurious to that of the apple as well.

The accompanying illustrations will enable the reader to distinguish between these two caterpillars whenever he meets with them.

Fig. 18.



Colors—(a and b) black, white, blue and rufous, (c) yellowish gray, (d) yellow.

Fig. 19.

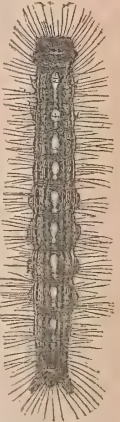


Fig. 18 represents the American Tent-caterpillar, (a) side view, (b) back view, (c) bracelet of eggs, (d) cocoon: Fig. 19, the Forest Tent-caterpillar. The most conspicuous difference, is that the former has a *white stripe* extending along the back from head to tail, while the latter has a series of white spots instead. The eggs from which these caterpillars proceed (Fig. 18, c) are laid by the parent moth in the end of June, or early in July, upon the smaller twigs of the tree, usually beautifully arranged in the form of a broad bracelet, containing about two hundred and fifty eggs. These eggs are always protected from the heat in summer and the cold in winter, by a thick leathery varnish, which serves also to keep out the wet and prevent the ingress of moisture, which in frosty weather would soon destroy the eggs. The same degree of warmth that causes the apple buds to swell and open out, hatches the little larvæ in the eggs; and they are thus enabled at once to find a supply of soft food suited to their tender powers of mastication and diges-

tion. Should the supply of food, however, prove insufficient for the brood of larvæ, or not be conveniently at hand, they feed upon the varnish-like substance for some time, and thus escape any danger of perishing by hunger. Next to satisfying their appetites, their chief occupation consists in constructing a shelter for themselves, by stretching masses of web across some fork of the tree near their place of birth. As they increase in size, they keep adding to this web, until it forms a large and conspicuous "tent," capable of containing the whole brood, and with room enough to permit of passage through from one part to another. Here they retire in bad weather and when not feeding; whenever they go out, they always proceed along the upper side of the branches and emit a silken thread as they go, which serves as a clue to guide them back to their abode. The principal thoroughfares to and from the "tent," soon become covered with a mass of these threads which thus form smooth silken roads for the creatures to travel upon.

They continue in the caterpillar state for five or six weeks, feeding voraciously all the time, and very often stripping entire boughs of their foliage; indeed, where they have been suffered to go on without molestation, they have been known to strip whole orchards of their leaves, rendering them as bare as in mid winter. After arriving at maturity, they leave the trees and crawl about in all directions to find secluded spots in which to form their cocoons; the crevices of fences, sheltered angles of buildings, loose bark of old trees, and neglected rubbish on the ground are favorite localities. The cocoon (Fig. 18, d) is formed of a double web, the outer one loosely woven, and of very slight texture, and the inner tough and thick; between the two webs is usually a quantity of yellowish dust, resembling powdered sulphur in appearance. In this state the insect continues for about three weeks, and then comes forth as a pale brownish, thick-bodied, and by no means handsome, moth, whose wings are crossed by two oblique, parallel, whitish lines, as seen

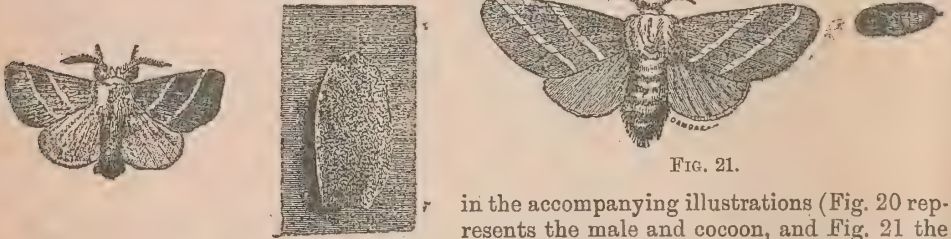


FIG. 20.

FIG. 21.

in the accompanying illustrations (Fig. 20 represents the male and cocoon, and Fig. 21 the female moth and pupa.) The month of July

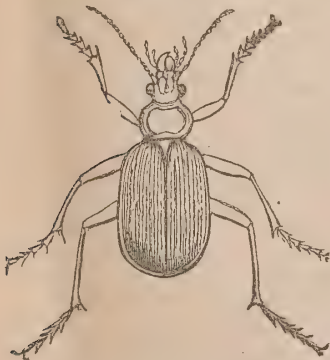
is the period when these moths are most abundant; they then swarm about our lamps at night, and with a little trouble might be very much diminished in number, when they thus come to us to be killed. Their individual life in the moth state is very short, not lasting more than a few days, during which they pair and provide for the continuance of their race, the female laying her bracelet of eggs, from which the next year's brood is to come. Thus far we have been treating of the American Tent caterpillar (*Clisiocampa Americana*, Harr.); the other species, the Forest Tent caterpillar (*C. sylvatica*, Harr.) resembles it so much in general appearance and mode of life, that we need say but little respecting it. The larva, as we have already pointed out, has a series of white spots along its back instead of a white stripe, and differs also from the other species in not constructing a large "tent," under which to live with its fellows, but merely making a sort of web on the side of the trunk or large branches, on and about which it lives more or less in community, but with nothing like the same social tastes as the other species. The moths differ a good deal from, though they bear a general resemblance to *C. Americana*; the chief variation is in the color, which is paler, and more of a reddish-yellow hue, and in the stripes, which are dark instead of whitish, and not nearly so conspicuous. *C. sylvatica* also very frequently forms its cocoon amongst the leaves of the tree upon which it has been feeding, a practice which we have never observed in the case of the other. The natural food of the Forest Tent caterpillar is evidently the leaves of most of our common forest trees, but of late years it has been most destructive to apple and other cultivated trees. In June, 1866, the editor of the *Canada Farmer* (p.

217) relates that in the course of a short journey from Toronto (in which direction he does not tell us) he came upon a large orchard, which was almost as bare and leafless as in mid-winter, having been stripped of its foliage by the Tent caterpillar. Passing on a little further he came to another, and yet another, in the same plight: "they were utterly leafless, fruitless, and apparently dying, all from the same cause." It is difficult to say which species produced all this damage, but from his account of their ravages, and his mention of the wandering propensities of the caterpillars, we should judge that it was the Forest and not the American species. In July, 1867, we drew attention in the same publication (*Canada Farmer*, p. 221), to a case of abominable negligence, in the neighborhood of Port Talbot, which permitted thirty acres of orchard to be completely devastated by these caterpillars. In June, 1868, Mr. Beadle mentions (*Price Essay*, p. 174) that innumerable legions of this caterpillar swept over the orchards in the neighborhood of St. Thomas, and that they were very abundant throughout all the country between that place and London, Ontario. Mr. Saunders has informed us that they have almost taken the place of the *C. Americana* in the neighborhood of London, the latter species being not nearly so numerous as in former years. East of Toronto, however, we have not found this caterpillar particularly numerous, while the other is universally abundant.

The remedies for both these pests may be divided into two classes:—artificial and natural. The former are, in a few words, (1) to search the orchard carefully in early spring, before the buds are swollen, or indeed at any time during the winter, and *cut off all the bracelets of eggs and burn them*. They will be found near the ends of the shoots, seldom more than a foot distant from the tip, and sometimes not an inch. A little practice will soon enable one to detect them instantly. A cloudy day should be chosen for the work in order to avoid the inconvenience of too much glare from the sky. (2) Go through the orchard or garden regularly twice a week, from the time the buds begin to open till the trees are in full blossom, and *remove all the tents with their nests of caterpillars*. When the nests are small they may be crushed in the gloved hand without difficulty. When they are high up and out of reach, they may be brought down by means of a pole, with a bunch of rags attached to the extremity. (3) *Search for and destroy the cocoons* about the end of June, in the positions that we have mentioned above. (4) *Kill all the moths of these two species that are attracted by light*.

The natural remedies, which we have only to let alone to do their work, are (1) a very minute fly (*Platygaster*) the larvæ of which live in the eggs of the tent-caterpillars, and destroy great numbers (see *Canada Farmer* 1866, p. 135). (2) A two-winged fly (*Tachina*)

FIG. 22.



Colors, Metallic-Green, Purple and Copper.

about the size of and much resembling a common house-fly, and a four-winged fly (*Pimpla*), both of which are parasitic upon the caterpillars. (3) Various species of ground-beetles (*Carabidae*), which devour great quantities of these caterpillars. Fig. 22 represents the green caterpillar-hunter (*Calosoma scrutator* Fab.), which though not common, does good service. There are also many other good friends of this character besides these.

One word more and we have done with these pestilent creatures. We are strongly of opinion, that the Government of this country should compel under penalties the destruction of the webs or tents of these and other noxious caterpillars. They are so conspicuous that it is only carelessness and indolence that suffer them to increase upon us, and there can be no excuse for their neglect.

12. THE WHITE MARKED TUSSOCK CATERPILLAR (*Orgyia leucostigma*, Sm. and Abbott).—During the winter when our apple-trees ought to be destitute of leaves, we occasionally see a single leaf or cluster of leaves attached to a twig. If these are examined they will in almost all cases be found to contain an old grey cocoon, and the greater number to have a mass of eggs, covered with a white, glistening, froth-like substance attached to them as well. These eggs, two or three hundred of which may be found upon

a leaf at once, are the first stage of the



FIG. 23.

yellow hairs along the sides of the body; the head is bright coral red, the next segment has two long pencils of black hairs projecting forwards; and the last segment but one, a single similar pencil pointing backwards; on the fourth and three following segments there are short thick brush like tufts of yellowish hairs; and on the ninth and tenth two little coral-red knobs or warts.

These caterpillars feed singly on the leaves of apple, plum, and a large number of other trees; sometimes, when they are numerous, doing a good deal of damage. When full fed they spin their thin silken cocoons on twigs of the trees which they frequent, or on fences; in the former case they draw down a leaf as a covering, and firmly attach it to their cocoon. The male

cocoon is white, or yellowish, and so thin as to shew the insect through it (fig. 23 *d*, the male chrysalis); but the female cocoon is twice as large and much more firmly constructed, and contains also a different shaped and much larger chrysalis (fig. 23 *c*). The insect remains about a fortnight in the chrysalis state, and then comes forth in the form of a moth. The male (fig. 25) has broad ashen-



FIG. 24.

grey wings, which expand about an inch and a quarter; the fore-wings have a few indistinct black lines across them, and a white crescent-shaped dot near the lower corner, the antennæ are broadly and beautifully feathered, the tips of the plumes bending forward and approaching each other. The female, on the other hand, is extraordinarily different, and would never be suspected of laying claim to the title of moth; she has the merest rudiments of wings, which are not observable except on close inspection, and thin simple antennæ; in fact she is more like an animated bag of eggs than anything else. (Fig. 23 *a* represents her attached to her cocoon.) Being unable to fly, she remains on her cocoon, where she is found by her mate, whose boastful ostentatious flight is the origin of the English name of "Vapourer."



FIG. 25.

After pairing, the female lays her eggs upon the cocoon, covers them with the curious frothy matter, which becomes hard and brittle and protects them from the weather, and then—her work accomplished—drops down and dies.

The best remedy for these insects, when sufficiently numerous to be troublesome, as they often are, is to go round the orchard during the winter, and take off all the cocoons that have eggs attached to them. They can be at once discovered by their attendant withered leaf. Those that have no egg masses on them should be left, Mr. Riley recommends, as they either contain the empty male chrysalis, which is harmless, or some friendly parasite. This work can be accomplished at the same time as the search for the egg-bracelets of the Tent-Caterpillars is carried on.

13. THE YELLOW-NECKED APPLE-TREE CATERPILLAR (*Datana ministra*, Drury).—In the summer of 1865, many fruit-growers in the neighborhood of Toronto, and in other parts of the Province, were alarmed by the appearance upon their apple trees of masses of strange-looking and very voracious caterpillars. The first intimation usually given of the

presence of these creatures was the complete denudation of some branches of the trees, and on making a close inspection, the owner would find a community of caterpillars busily engaged in the work of destruction.

These noxious insects, though formerly rare and seldom noticed in Canada, have been long observed in the United States. So early as the year 1773, Mr. Drury, a distinguished English entomologist, described and figured the moth into which these caterpillars turn, specimens having been collected for him in the State of New York. He named it the *Phalena ministra*, the Handmaiden Moth; it is now known by the appellation of *Datana ministra*, or the Yellow-necked Apple-tree Caterpillar. Dr. Fitch relates its occurrence in great numbers in the State of New York in 1853 and 1856; in 1868 we noticed it in several localities, as well as in 1865, but it is not abundant every year. It belongs to the family Notodontidae, of the order Lepidoptera, most of the members of which are very destructive in their habits. The great peculiarity of this family, and one which is eminently characteristic of the species before us, is the extraordinary posture often assumed by the caterpillars. When at rest after eating, they are usually crowded together as closely as possible upon the twigs where they have been feeding, clinging to them with the four intermediate pairs of pro-legs, and with the extremities of their bodies raised up-

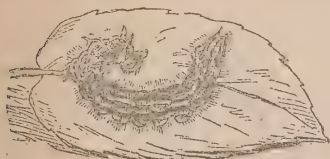


FIG. 26.

wards. If touched, or otherwise disturbed, they throw their tails upward with a jerk, and at the same time bend their heads backwards semicircularly, till the two extremities almost meet. In this position they will remain for a considerable time, presenting, as may be imagined, a very odd and grotesque appearance. The accompanying illustration (Fig. 26) will enable the reader to form some idea of this peculiarity, as well as of the ordinary appearance of the caterpillar.

The eggs from which these caterpillars come forth are laid in patches of about a hundred together, on the under side of the terminal leaves of a limb, and the young are hatched out about the end of July, or beginning of August; sometimes there are other broods later in the season. At first they eat only the green substance (parenchyma) of the under side of the leaves, the upper side and veins remaining untouched; but as they gradually increase in size and powers of digestion, and consequently of appetite also, they consume all but the stem, and a portion of the mid rib. Beginning, thus, with the fresh and tender leaves at the end of the branch, they descend by degrees, devouring all before them, till the limb is perfectly bare.

When first hatched from the egg, these caterpillars are less than a quarter of an inch in length, tawny yellow, with black heads and feet, and four narrow, pale yellow stripes along each side of the body, the whole being thinly clothed with fine whitish hairs. When fully-grown, the ground color of the caterpillar is black, with the pale yellow stripes as at first; the head is black, the second segment, or neck, as it may be termed, is yellow and wax-like (whence its common English name); the fore-legs and claws are black, while the four pair of intermediate pro-legs are waxy yellow, spotted with black. Its greatest length is about two inches.

The caterpillar state lasts five or six weeks, at the end of which time they descend to the earth, and become transformed into chrysalids, a few inches below the surface; there they remain till the following summer, the perfect insect or moth not appearing till the following June or July.

These moths are of a light brown color; the head and a large rectangular spot on the thorax are deep chestnut brown; the fore wings are crossed by four nearly parallel lines, of a rusty brown color; the hind wings are pale yellow, without markings. They measure from an inch and three-quarters to two inches and a half across the wings. The moths themselves are not very often met with, but are sometimes attracted indoors by lights at night.

The best mode of staying the ravages of the caterpillars is to go round all the trees in the garden or orchard, and examine closely wherever the end of a branch appears to be stripped of its leaves. Should this insect be the cause of the denudation, it will be readily found, and the caterpillars can be easily destroyed by simply cutting off the twig on

which they are clustered, and throwing it into the fire. An orchard can in this way be effectually cleared of the pest in a very short space of time, and without any great amount of labor. This summer (1870) we found a number of these caterpillars on one of our apple-trees, but we had no difficulty in getting rid of them. One specimen we found swarming with maggots of a minute *Ichneumon*, which have since gone through their stages of cocoon and perfect flies; but we have not yet determined the particular genus or species to which they belong. They no doubt serve to keep these insects very much in check, and probably are one of the causes of their irregular appearance from year to year.

14. THE RED-HUMPED APPLE-TREE CATERPILLAR (*Notodonta concinna*, Sm. and Abbott).—This insect belongs to the same family as the preceding species, and resembles it very much in its habits and mode of life—so much so, that we need give but a very brief description of it. It usually makes its appearance in July or August, and reveals its presence by stripping the leaves from whole branches, commencing at the top, just as the Yellow-necked Caterpillar described above. When full grown, they are about an inch and a quarter in length; their general color is yellowish red above and below, and white on the sides, with thirteen narrow black stripes extending from the head to the tenth segment, interrupted only on the fourth segment by a prominent hump, of an orange-red color (whence the insect's name). There are two rows of black prickles along the back,



FIG. 27.

and a number of shorter ones on the sides, each of which terminates in a fine hair; on the second, third and fourth segments, these prickles are lengthened into spines; the eleventh and twelfth segments are entirely yellow, without any black lines, and the last segment is black. The head is bright, shining red, with black jaws. Towards the end of summer, the caterpillar forms its chrysalis in the earth, and the moth appears the following year. It is a common-looking light-brown insect, with dark-brown and greyish markings. Fig. 27, (1) represents the caterpillar, and (2) the moth. "There is one peculiarity about this caterpillar which we have not noticed in any other. When handled, it discharges a clear liquid, having a strong acid smell and taste. This is probably given as a means of defence against birds, since their feeding in flocks, and so openly, would render them particularly liable to attacks from these active foes." (*Canada Farmer*, 1869, p. 339.)

These caterpillars, when numerous, may be treated as the foregoing species; or they may be dislodged by a quick, jarring blow upon the limb, and received on a cloth or sheets of newspaper spread below. An end may then be put to their existence by beating with a spade, or trampling under foot.

15. THE FALL WEB WORM (*Hyphantria texior*, Harris).—After all the Tent-Caterpillars' webs have been carefully and effectually removed from the trees in the spring, the fruit-grower may be surprised and mortified to find his trees again beset with webs towards the end of summer, and be inclined to give up fighting the worms as a hopeless case. If, however, he examines the autumn webs, he will find that the caterpillar that has produced them is different from any that we have so far described, and not at all like the Tent-Caterpillars of the spring. These webs are very large and thin, and are generally formed all over the end of a branch, and not in a fork. The caterpillars vary in their general color from black to blue and greenish; they have a broad, blackish stripe on the back, in which, when nearly full grown, a blue line appears. On each segment (except the two at each extremity, which have fewer,) there are twelve little warts, from which bundles of whitish hairs proceed, viz.: four rust-yellow or orange on each side, two black ones in a line with them on the back, and a little in front and between these two smaller ones, also black at first, but becoming rust-yellow when the caterpillar is older. In feeding, they at first only eat the softer parts of the leaves, the stalks and net-work of veins being left; but afterwards, they consume pretty nearly everything that comes within their fatal net. When full grown, they disperse, and spin their cocoons in crevices of the bark, and other sheltered places. The moth appears the following summer, and is of a milk-white color, without any spots or other markings upon the wings.

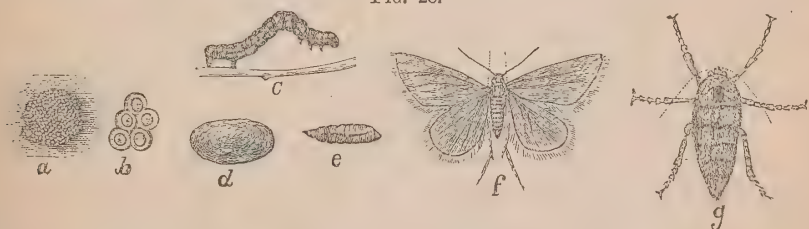
Though these webs are very common upon the apple, they are even yet more numerous on the wild-cherry, which appears to be their original food plant. They also attack the hickory, ash, elm, willow, oak, birch, button wood and some other trees.

The best remedy, probably, is to cut off the infested boughs and burn them.

16. THE CANKER-WORM (*Anisopteryx vernata*, Peck)—This insect, though very common in many parts of the United States, and exceedingly destructive where it occurs, is not often met with in Canada. The only native specimens we have seen, were sent us in April, 1867, by our friend Mr. J. Pettit, of Grimsby, who stated that he first noticed them late in November of the previous year, but that he found the females at different times during the winter under the bark of trees. We gave an account of the insect at the time in the *Canada Farmer*, (May 1st, 1867, p. 133,) from which we extract the following: The Canker-worm belongs to a family of moths called Geometers, or "Measuring-worms," or "Span-worms," from the mode of locomotion employed by the caterpillars in consequence of the absence of legs under the middle portion of their bodies. They have three pairs of legs near the head, and two pairs at the other extremity, and when walking, they draw up the hind legs close to the fore ones, doubling up the body in the form of an inverted letter Π , then they stretch out the fore legs as far as possible, draw the hind ones up to them again, and so on, looking just as if they were spanning or measuring the surface they are on. The moths from which they are produced, are called the *Anisopteryx vernata*, Peck; the former name meaning "unequal-wing," because the sexes differ so much in the dimensions of their wings,—in this case the female has no wings at all, and (like the female of *Orgyia leucostigma*), would never be taken for a moth by one unacquainted with entomology; the latter name means "spring," because the moth is most commonly seen in the spring of the year.

The male moth has very delicate silky wings, broad in proportion to their length, which overlap each other when the insect is at rest; the fore pair are ash-colored, with a whitish spot near the tip on the front margin, and two indistinct zigzag whitish bands across them, which are sometimes wanting; the hind pair are paler and have a blackish dot near the middle; all the wings have rather long, pale fringes; they expand about an inch and a quarter. The wingless female is ash colored above and greyish beneath; of an oblong-oval form, tapering to a point behind. The accompanying wood-cut (Fig. 28),

FIG. 28.



exhibits the insect in its various stages. (Fig. 28, (a) eggs, natural size; (b) do. magnified; (c) caterpillar; (d) cocoon; (e) chrysalis; (f) male moth; (g) female).

Late in the autumn, after the first hard frosts are over, and mild genial days come on, these moths issue from their pupa cases in the ground and continue to come forth, whenever the weather is mild, all through the winter, appearing in the greatest numbers early in the spring. The sluggish females at once crawl up the trunk of the nearest tree, where they are soon joined by the more active flying males; after pairing has taken place, the female proceeds to the branches of the tree, where she lays her eggs, placing them in clusters of from sixty to upwards of a hundred. From these the infant caterpillars hatch out as soon as the young leaves of the tree begin to expand and afford them a supply of suitable food. At first, from their small size, they attract but little notice, but during the latter part of their larval existence, they grow rapidly and eat so voraciously as to divest the tree of all appearance of greenness. "When very young,"—according to Harris—"they have two minute warts on the top of the last ring, and they are then generally of a blackish or dusky-brown color, with a yellowish stripe on each side of the body; there are two whitish bands across the head, and the belly is also whitish. When fully grown, these individuals become ash-colored on the back, and black on the sides, below which

the pale yellowish line remains. Some are found of a dull greenish-yellow, and others of a clay color, with slender interrupted blackish lines on the sides, and small spots of the same color on the back. Some are green, with two white stripes on the back. The head and feet partake of the general color of the body; the belly is paler. When not eating, they remain stretched out at full length, and resting on their fore and hind legs beneath the leaves. When full grown and well fed they measure nearly or quite one inch in length. They leave off eating when about four weeks old, and begin to quit the trees; some creep down by the trunk, but great numbers let themselves down by their threads from the branches, their instincts prompting them to get to the ground by the most direct and easiest course. After reaching the ground, they immediately burrow in the earth to the depth of from two to six inches, where they make little cavities or cells in the ground, by turning round repeatedly and fastening the loose grains of earth about them with a few silken threads. Within twenty-four hours afterwards they are changed to chrysalids in their cells."

The trees most commonly frequented by these worms, are the elm and basswood of the forest, and the apple, pear, cherry and plum, of the garden or orchard. When they appear in large numbers, as indeed they commonly do, they completely strip the trees of their foliage, and, though they make an effort to put forth a fresh crop of leaves the same season, and occasionally produce a few blossoms and immature fruit, if the defoliation is repeated, the effect is certain death to the afflicted trees.

Remedies.—As the female moth is wingless, and is obliged to crawl up the trunk of the tree in order to deposit her eggs, from which the destructive caterpillars are produced, it is evident that the simplest and most effectual remedy will be to prevent her from gaining access to the required positions by placing some obstacle around the trunk of the tree. The cheapest and readiest plan is to fasten bandages, three or four inches wide, of old sacking or rags, tightly around the trunk of the tree, say two and a half or three feet from the ground; smear them well with a thick clay wash, and on this, when dry, spread as much tar as will cling to the bandage without running over the bark and thus injuring the tree. The tar should be applied shortly before sun-down, as the moth is nocturnal in its habits, and should be renewed every warm and mild evening, as long as the moths are about. This may appear a troublesome operation, but where canker worms are prevalent it is far preferable to losing one's choicest fruit trees. To prevent the tar from becoming dry and hard, any common oil may be mixed with it to advantage.

As this pest is so very destructive and so well known to our ingenious neighbors, it is not at all surprising to find that they have invented and patented various "tree protectors," and other apparatus for circumventing these insects. One kind consists of a strip of india-rubber cloth, an inch wide, which surrounds the trunk of the tree, and has projecting from it, "at an angle of forty-five degrees," a strip of tin or zinc about three inches wide. The smooth sloping surface of the metal is calculated to interfere with the climbing propensities of moth. Another—"Foster's tree protector"—consists of a narrow trough of tin, suspended to the trunk of a tree by a strip of cotton, and intended to be filled with oil. A third—"Merrit's Patent tree protector"—is much more elaborate and expensive, though possibly not more effective. It is composed of a grooved circle of glass surrounded with iron, and hung to a tent-like piece of cloth, which keeps the glass some inches distant from the tree-trunk. The moths are expected to be all captured within this tent, being unable to ascend any higher; unfortunately, however, the young caterpillars are able to crawl over the smoothest glass by means of the glutinous silken thread they spin.

A belt of sheepskin saturated with kerosene oil, and with the woolly side out, is said to be, and if carefully applied and kept constantly saturated probably is, a useful protector; but we should strongly advise our readers who are in search of a remedy, to have nothing to do with many Yankee nostrums as useless as they are absurd. Such, for instance, is the often recommended plan of boring holes in the tree, and inserting lumps of sulphur, in order to poison the worms! This remedy cannot possibly hurt the worms, as the sulphur will remain unchanged in the tree for years, but may possibly be as injurious as the insect itself. Some, again, drive nails into the tree with the same object; another has recommended quicksilver as infallible; while yet another speculator sells

what he calls "muriate of lime," that is, burnt-oyster shells and salt, and declares that a moderate application of this to the base of the tree is a sure preventative! Such are some of the modes in which the unprincipled try to dupe their ignorant or simple-minded fellow-creatures, who learn too late that they have bought the nostrum or recipe only to be "sold" themselves.

17. THE CECROPIA EMPEROR CATERPILLAR (*Samia* [*Saturnia*] *Cecropia*, Linn).—Until recently we regarded this gigantic insect as too rare to be classed amongst our foes, but it has lately become so common in many quarters that we fear fruit growers must begin to consider it as an occasional enemy. Few who see for the first time specimens of this and other large native insects are willing to believe that they are really indigenous to Canada, and not importations from some tropical country. Our Emperor Moths, four species of which we have in Canada, are certainly so large in size and so splendid in ornamentation that every beholder must regard them with admiration, and be willing to spare them for



FIG. 29.

Colors—Green, Blue, Yellow and Red.

their beauty's sake, even if they should prove destructive. They all belong to the same family (*Bombycidae*) as the noted silk worm, whose productions afford employment to thousands of our fellow-creatures, and subserve the comfort and luxury of a large portion of the human race. From one of our species, the Polyphemus Moth, that feeds upon oak leaves, excellent silk has been obtained by Mr. Trouvelot, of Medford, Mass.; and a coarse but strong fabric has occasionally been manufactured from the cocoons of the species before us.

The Cecropia Emperor Caterpillar is hatched from a little round egg, flattened above, of a whitish color shaded with brown. The young larva is very tiny at first, but speedily grows until it becomes a perfect giant among caterpillars. When of full size it is about four inches long, and presents the appearance of the accompanying illustration (fig. 29). The general color of the body is a beautiful pale-green; the tubercles or



FIG. 30.

Color—Pale-Brownish.

warts on the top of the first and last two segments are blue, those on the second and third coral-red, and those on the remaining segments yellow; the smaller tubercles on the sides are blue. As may easily be imagined, the insect presents a very handsome appear-

ance, being thus adorned with so many bright colors. When it has completed its growth it proceeds to spin a large pod-shaped silken cocoon (fig. 30), attaching it on its flat side to a twig of some tree. This cocoon consists of two envelopes of silken fibres agglutinated together; the outer is loose and wrinkled, and somewhat resembles a coarse pale-brown paper; the inner is much more closely woven and is separated from the outer by a quantity of soft loose silken fibres. Snugly ensconced within these two wrappers lies the chrysalis, safely protected from the frost, and unaffected by the variations of temperature during the winter. About the end of May or beginning of June the moth comes forth, a magnificent, soft brownish creature, with dull red and white ornamentation. The accompanying wood-cut (fig. 31), exhibiting a male of this splendid species, will render any detailed description unnecessary. Every reader who captures one of these moths will have no difficulty in at once recognizing the species.



FIG. 31.
Colors—Brownish, Dull Red and White.

Until we saw a young plum tree at Collingwood this summer being ravaged by a brood of these caterpillars, we did not think that they were ever sufficiently numerous to require the application of a remedy; but in such a case, of course, it was death to the tree to allow them to remain. Their large size and gay colors render their detection easy in the caterpillar state, and they can be killed by coal oil, boiling water, or stamping under foot. The most effective remedy, however, would be to go round the orchard or garden in the winter and cut off the cocoons, which are so large and conspicuous as to be at once seen. Search should be made for them not only on apple trees, but on a large number of others, such as the cherry, plum, hickory, birch, elm, maple, willow, honeylocust, lilac, barberry, hawthorn, currant, elder, hazel, &c. The caterpillar is so very subject to the attacks of parasitic insects, especially a *Tachina* fly, that we do not think it is ever likely to become a grievous plague to fruit growers, as are so many of the insects that we are now describing.

18. THE RASCAL LEAF-CRUMPLER (*Phycita nebulo*, Walsh).—Yet another insect has lately been observed to affect the leaves of the apple to an injurious extent; we must not, therefore, allow it to pass unnoticed. It was first described by Mr. Walsh, the late State Entomologist of Illinois, in 1860. We have not met with it ourselves, and consequently

cannot give any account of our own respecting it ; we take pleasure, however, in transcribing from the pages of the *Canadian Entomologist* (vol. ii., p. 126), the following excellent account furnished by our esteemed co-adjutor, Mr. Saunders :—

“ While looking over some apple trees, on the 23rd of May, I observed the work of a small case-making larva, which I had never noticed before. Its case resembled a long miniature horn, wide at one end, tapering almost to a point at the other, and frequently twisted in a very odd manner. There were generally portions of dead leaves fastened around the case, so as to partially conceal it, and a firm base of attachment was made for it by gnawing off the young bark from the twig on which it rested, and then firmly glueing it with some glutinous secretion to the spot thus laid bare. The case was curiously constructed of silk, interwoven very cleverly with the excrement of the artificer, and had a smooth, whitish surface internally, with an exterior also smooth, but of a yellowish brown color.

The larva lives inside this curious structure, coming out only when it wants food, and quickly retreating when danger threatens. Its length, when full grown, is about six-tenths of an inch, with a body tapering slightly towards the hinder extremity. Its head is medium sized, rather flat, dark reddish brown, with a dull roughened surface, mandibles or jaws dark shining brown.

The body above is dark, dull brown, with a slight greenish tint, the second segment being nearly covered above with a horny-looking plate, similar in appearance to the head, but a little paler, and edged behind and at the sides with a darker shade—on each side below this plate is a flattened, blackish prominence—on each side of third segment is also placed a small, shining, black tubercle. On each segment from the third to terminal inclusive, are several very minute blackish dots, from each one of which arises a single pale brown hair.

The under surface is a little paler than the upper, with a more decided greenish tint, feet green banded, and tipped with brownish black, pro-legs dull greenish brown.

It changes to a chrysalis sometimes, and I think usually within the case. I found them thus changed in some cases on the trees, but one or two of the specimens among those brought home and fed, came out of the case, and changed to a pupa on the outside. The chrysalis was about four-tenths of an inch long, and of a reddish brown color. One specimen was observed to effect its change on the 8th of June, and produced the winged moth on the 21st of the same month, showing the duration of the pupa stage to be about thirteen days.

On examination, the moth proved to be the *Phycita nebulo* (Walsh), to which he has given the significant common name of “The rascal leaf crumpler.” In Mr. Walsh’s excellent Report on the noxious insects of Illinois, he states that this larva affects the plum and wild crab, as well as the cultivated apple. The young larvæ appear late in the summer and construct their little cases, surrounded with portions of dried leaves, in which they pass the winter in a torpid state, awakening to activity and resuming their depredations as soon as the young foliage expands in spring. He was of opinion that this insect was confined exclusively to the North Western States ; its occurrence in Canada shows that in this his views were incorrect. Although he had bred a number of specimens, he had never found them preyed on by any species of ichneumon fly, whereas in my own case, although I only bred seven or eight, one of them produced an interesting ichneumon, the name of which has not yet been determined.

The moth is a pretty little thing ; its wings measure, when expanded, about seven-tenths of an inch. Its fore-wings are pale brown, with patches and streaks of silvery white ; the hind wings are plain brownish white ; the under side of both wings is pale whitish brown, the hind wings paler than the fore-wings. It is figured and described by Mr. Walsh, in the Proceedings of the Boston Society of Natural History, vol. 9, p. 312-3.

The amount of damage done by this insect in my own case was not great ; their numbers were not sufficient to cause much alarm ; but when they are very numerous, one can easily imagine that their destructive powers would be very considerable, for besides consuming the foliage, their pernicious habit of gnawing away all the young bark from and about the spot to which the case is attached, would, in all probability, lead sometimes to the girdling of the young branches, and their consequent death. The little bunch of dead

and dried leaves around their cases gives a ready means of detecting the presence of these little rascals, and no better remedy for them than hunting them up, and crushing the case with the hand, has yet been suggested."

The patient reader must assuredly think by this time that the catalogue of caterpillars infesting the leaves of the apple tree is quite long enough. We shall refrain, then, from wearying him with descriptions of any more, but shall content ourselves with simply enumerating the names of some other Canadian species that feed wholly or in part upon this favorite tree. They are the following: The caterpillars of the Tiger Swallow-tail Butterfly (*Papilio turnus*, Linn.); the Blind-eyed Sphinx (*S. excaecatus*, Sm. & Abbot); the Apple Sphinx (*S. gordius*, Cramer); the American Lappet Moth (*Gastropacha Americana*, Harris); and the Rose Tortrix (*Lozotaenia rosaceana*, Harris).

AFFECTING THE FRUIT.

19. THE CODLING WORM (*Carpocapsa pomonella*, Linn.)—In 1868 the apple crop throughout this province was very materially diminished by the depredations of this little worm; in some parts of the country fully one-half of the fruit was either completely destroyed or rendered unmarketable. Last year and this year, however, we are thankful to say, its ravages have been very considerably diminished.

The Codling-worm is an European insect that, like so many other importations, has flourished and increased enormously in this Western world. It proceeds from an egg laid by the parent moth, within the eye or blossom end of the apple, in the month of July. As a rule, only one egg is laid on each apple, but a few rare instances are recorded of two. In a few days the egg is hatched, and the worm at once proceeds to burrow into the fruit; it directs its course towards the core, eating as it goes, and thrusting out its excrement, in the form of a fine powder, through the hole by which it entered.

When it reaches the heart of the apple it eats a cavity about the core, and destroys some of the seeds; after a time it eats a tunnel through to the side of the apple, and makes use of it for the discharge of its castings and refuse; it also avails itself of this aperture to make its escape when full grown. The accompanying illustration (Fig. 32, from Riley's Report) shows this insect in all its stages; *a* represents a section of an apple which has been attacked by the worm, showing the burrowings and channel of exit to the left; *b*, the point at which the egg was laid and at which the young worm entered; *c*, the full-grown caterpillar; *d*, its head and next segment magnified; *e*, the cocoon which it spins; *f*, the chrysalis into which it changes; *g*, the moth which escapes from the chrysalis, as it appears when at rest; *h*, the same with its wings expanded.

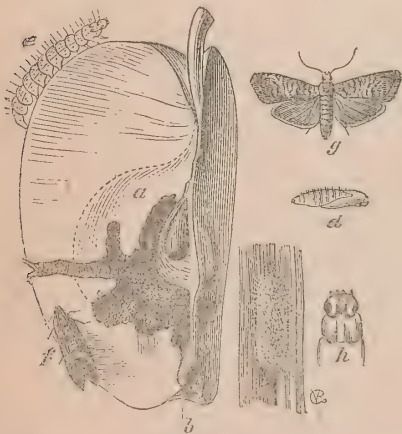


FIG. 32.

The caterpillar, when full grown, is about half an inch long, of a pale reddish or pinkish color, and with the head and succeeding segment marked with brownish, as shown in Fig. 32, *h*. On each segment there are a few fine hairs, scarcely discernible by the naked eye, arising from minute elevated points. It possesses the power, like many other caterpillars, of letting itself down from the tree by means of a fine silken thread which it spins. The chrysalis is of yellowish brown, and is enclosed in a cocoon of white silk, disguised on the outside with fragments of the substance to which it is attached. In order to make its way partly out of the cocoon, when ready to assume the perfect state, the chrysalis is furnished with a double row of spines or teeth on its back. The moth, which appears in June, is a very pretty little creature, but is seldom seen, on account of its habit of concealing itself during the daytime and only coming forth at night. Its expanded wings measure about three-quarters of an inch; its fore wings are marked with alternate streaks of ashen grey and brown, and have, on the inner angle of each, a large tawny brown spot, with streaks of bright metallic lustre; the hind wings are pale reddish brown, and of a satiny texture.

This insect is regarded as double-brooded in Europe, and appears to be so in this country as well, though perhaps not universally. Mr. Saunders, in 1868, reared the moth early in August, from fruit gathered late in July, and found young specimens of the worm again quite late in August. Mr. Walsh stated, in his first report on the noxious insects of Illinois, that he was satisfied that there were two distinct broods in the year in that State. Mr. Riley, in his first report as State Entomologist of Missouri, is of the same opinion as regards his locality. He writes: "The female flits from blossom to blossom, deftly depositing in the calyx of each a tiny yellow egg. As the fruit matures, the worm develops. In thirty-three days, under favorable circumstances, it has become full fed, when, leaving the apple, it spins up in some crevice, changes to chrysalis in three days, and issues two weeks afterwards as moth, ready to deposit again, though not always in the favorite calyx this time, as I have found the young worm frequently entering from the side. Thus the young brood of codling moths appear at the same time as the young curculios, the difference being that instead of living on through the fall and winter, as do the latter, they deposit their eggs and die, it being the progeny from these eggs which continues the race the ensuing year."

Our own opinion is that the insect is double-brooded, because we have found fully matured larvæ in the ripe early Harvest apples in August, and others of the same size in September and October in the ripe autumn apples; the latter we should naturally infer were of a different brood from the former. This, of course, would not be sufficient in itself, but it has weight when coupled with the other testimony given above. This point is important when we come to apply remedies for the insect, for if we take it for granted that there is only one brood, we shall be letting the earlier go scot free.

Let us now consider the remedies for this pest. The simplest remedy is to gather up all the fruit that falls before the worm has time to leave it, and destroy the enclosed larva by dipping in boiling water, or feeding to pigs. Where practicable, pigs may be suffered to roam through the orchard and gather up the wormy fruit for themselves. This remedy is very good and useful, and indeed a highly advisable one to employ, but it obviously does not affect the worms that have left the fruit before it falls to the ground. To catch these there is an excellent plan, originated by Dr. Trimble, of New Jersey; it is simply to bind hay ropes around the trunks of the trees, two to each tree, one low down, the other tolerably high up the trunk. These are taken possession of by the worms when looking about for a convenient place in which to make their cocoons, and by carefully examining the bandages every week during the season, large numbers of the insects may be found and destroyed. An improvement on this plan is to substitute rag bandages for the hay ropes—pieces of old carpet will answer very well—take them off every week, pass them through a clothes wringer, or dip them into boiling water, and the worms are all done for; then replace them on the trees for another set, and so on through the season. To be thoroughly effectual these bandages should be placed around the trees about the first of June and kept on as long as an apple remains upon the tree; they should be examined once a week; the trunk of the tree should be kept free from rough or loose bark, and the ground from weeds or rubbish, so as to give the worms no other place of concealment but the bandages.

One more precaution is still necessary. When the fruit is gathered in the autumn and stored away, there are still a great many worms in the fruit, as no doubt every apple eater has noticed occasionally to his disgust. These often remain for weeks in the apples, and then they come out in the cellar or storehouse and search about for the nearest convenient hiding place in which to assume the chrysalis state. A very favorite locality is the space between the hoops and the staves of the barrels. We have found hundreds in such positions, especially in the winter of 1868-9; and Mr. Riley relates a similar experience. Where this occurs, it is by all means worth while to scald the barrels thoroughly outside as well as inside, as soon as they are emptied, or even to burn them. When boxes or bins are made use of for storing fruit, the worms are sure to find some crevices to suit them, which should be searched for and treated as in the case of the barrels.

20. THE APPLE CURCULIO (*Anthonomus quadrigibbus*, Say).—The common plum Curculio (*Conotrachelus nenuphar*, Herbst), of which a full description is given by Mr. Reed in another part of this Report, is known to attack the apple as well as its peculiar fruit

the plum, and oftentimes to do a considerable amount of damage. But there is another curculio, the "four-humped," or apple curculio, which bids fair to become a nuisance in our gardens and orchards. Though well known for some time to entomologists in the western part of this Province, it has only recently been much observed or regarded as destructive. Its natural food is the wild crab and the hawthorn; but now it is taking kindly to the cultivated varieties of the apple. In the September, 1870, number of the *Canada Farmer* (p. 337), we have recorded its occurrence at Milbrook, Ont., where "it had done a good deal of damage by eating a considerable portion of the surface of several apples."

This species may be easily distinguished from the plum curculio by its much longer and more slender snout; its color, which is dull brown, shading into rusty red behind; and by the four conspicuous humps on the wing covers behind the middle, which are brownish-red, and not shining black, as in the case of the plum curculio. The accompanying illustration gives an excellent representation

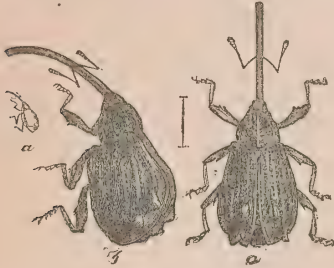


FIG. 33.

of the perfect insect, (Fig. 33, *a*, natural size; *b*, side view; *c*, back view of the beetle.) Unlike the insect affecting the plum, this creature makes round instead of crescent-shaped holes, most of them, apparently, for the purpose of eating, as but a small proportion of them have been observed to contain eggs or larvæ. It varies also in completing its transformations, as a rule, in the fruit instead of the ground.

The only known remedy for its attacks is vigorous and continued "jarring," a full account of which operation will be found under the description of the plum curculio in a subsequent part of this Report, and therefore need not be repeated here.

INSECTS INJURIOUS TO THE GRAPE.

BY W. SAUNDERS, LONDON, ONTARIO.

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|---|--|
| 1. The Green Grape-vine Sphinx (<i>Chærocampa pampinatrix</i> , Smith.) | 8. The Spotted Pelidnota (<i>Pelidnota punctata</i> Linnaeus.) |
| 2. The Beautiful Wood Nymph (<i>Eudryas grata</i> , Fabricius.) | 9. The Grape-vine Flea Beetle (<i>Haltica chalybea</i> , Illiger.) |
| 3. The Pearl Wood Nymph (<i>Eudryas unio</i> , Hubner.) | 10. The Grape seed Insect (<i>Isosoma vitis</i> , Saunders.) |
| 4. The Grape-vine Leaf-roller (<i>Desmia maculalis</i> , Westwood.) | 11. The Thrips (so called) (<i>Tettigonia vitis</i> , Harris.) |
| 5. The Grape-vine Plume moth (<i>Pterophorus periscelidactylus</i> Fitch.) | 12. The Grape-leaf Gall Louse (<i>Pemphigus vitifolia</i> , Fitch.) |
| 6. The Grape Cidaria (<i>Cidaria diversilineata</i> , Hubner.) | 13. The Tree Cricket (<i>Ecanthus niveus</i> , Harris.) |
| 7. The Common yellow Woolly Bear (<i>Spilosoma virginica</i> , Fabricius.) | 14. The Honey Bee (<i>Apis mellifica</i> , Linn.) |
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INSECTS INJURIOUS TO THE VINE.

The grape is now being cultivated extensively throughout our country, and since it has been shown that so large a portion of our soil and climate is well adapted to the growth of many of the best varieties, the culture of this valuable fruit is being greatly stimulated. Already many large vineyards have been planted in favored localities, and their numbers and dimensions are yearly increasing. Some growers cultivate chiefly those varieties adapted for table use, while others plant for wine making. The abundance of home-grown table grapes is materially lessening the yearly imports in this direction, and we feel assured that not many seasons will elapse before the yield will be so immensely increased, that the wants of our people will be abundantly supplied with Canadian fruit at very moderate prices.

With this in view, it becomes a matter of the greatest importance, that correct information should be disseminated regarding the habits and history of the many insect foes which attack the foliage and fruit of the vine, and the best means of preventing their ravages.

NO. 1. THE GREEN GRAPE-VINE SPHINX (*Chærocampa pampinatrix*, Smith.) One of the worst foes we have to deal with is this green Sphinx caterpillar, with a horn or tail on its hinder extremity. The moth from which this larva is produced, passes the winter in the chrysalis state, on or about the surface of the ground, enclosed in a rough case made of dry leaves or any other rubbish convenient. They appear in the winged state usually

from the middle to the latter end of May, when they pair, and in a few days afterwards deposit their eggs on the underside of the leaves. These are generally placed singly, but occasionally we have seen two and even three put quite closely together. Sometimes they are attached by the parent to the larger ribs of the leaf, at other times fastened on the intermediate substance. The egg is nearly round, one-twentieth of an inch in length, and a little less in width, exact measurement, length, .005, width, .0045 inch. It appears smooth with an ordinary magnifying lens, but under a power of forty-five diameters the surface is shown covered with minute punctures. Its color is pale yellowish-green, sometimes changing to reddish before hatching. We do not think this change of color always takes place, but have not watched it closely enough to be positive.

The young caterpillar comes out of the egg in about five or six days. This conclusion is based on one experiment only. This summer we had a number of eggs laid by a female, confined in a small box. They were deposited on the 25th of June, some hatched on the 30th, and most of the remainder on the 1st of July. They were kept in a cool room, which would be likely, somewhat, to retard their development; probably five days would be about the usual time under the ordinary influences of the sun and heat. As soon as the larva has found its way out, it makes its first meal on part of the empty egg shell, and then begins to satisfy its further cravings with the softer foliage of the vine. When first hatched it is one-fifth of an inch long, of a pale yellowish-green color, with a large head, and a long black horn on its posterior extremity, half as long as its body. As the larva increases in size, the horn becomes shorter and changes color, the markings of the body also vary much, and by the time it has attained three-fourths of an inch, it has materially altered its appearance. Its head is rather small, pale green with a pale yellow stripe down each side, and with a number of raised yellow dots or granulations scattered over its surface. Its jaws are tipped with black. The body is of a slightly deeper shade of green than the head, although, in this respect, different specimens vary, and also covered with similar pale yellow granulations. Along the sides of the body these latter are arranged in lines forming a series of oblique stripes extending backwards. On the back is placed a row of seven reddish dots, more or less distinct; in some specimens they are quite a deep red, in others very pale; occasionally they are united by a faint reddish line. The horn, which is placed on the twelfth segment or ring of the body, is one-fifth of an inch long, of a pale-reddish color, and thickly covered with minute black points. The under surface of the body is similar in color to the upper, and also granulated with yellow. The feet are red, and the thick fleshy prolegs pale green.

The full grown caterpillar (Fig. 34) is about two inches in length, of a similar color

FIG. 34.



Color—green, lilac and yellow.

to that just described, with the yellow granulations more distinct. The oblique lines are generally edged behind with a darker green, and there is a distinct line along each side, beginning at the head, where they are not far apart, diverging along the middle segments, and again approaching each other on the twelfth segment, where they terminate on each side of the caudal horn. The spots along the back vary in different specimens, from very pale lilac to red, as in the younger worm. This larva has the power of drawing its head or first segment, with the second and third, within the fourth and fifth segments, which cause these latter, at such times, to appear very much distended. The accompanying Fig. gives a very good idea of this pest, and will per-

haps be better understood than any merely verbal description.

This insect has, until of late, been usually regarded as single-brooded, but during the last two years we have watched them very closely, and feel well assured that they are

double-brooded with us. The eggs of the first brood were found this year about the middle of June, the young larvæ appearing in considerable numbers a few days later, developing into full size, and with full powers of destruction about the middle of July. They then entered the chrysalis state and produced the moths during the last days of July or first in August. These latter paired and deposited eggs again, from the middle of August to the beginning of September, which produced the second brood of larvæ, maturing late in September. Long after this occasional eggs were found, even as late as the middle of September, and an odd specimen of the larva was also found now and then till the middle of October, at which time two full-grown specimens were taken, and one about half grown. The former soon changed to chrysalids, but the latter died. Some examples of the larvæ, especially at this late season of the year, exhibit remarkable variations in color, assuming a delicate reddish pink hue, with markings of darker shades of red and brown. This so materially alters the appearance of the caterpillar, that it might be readily mistaken at first glance for a different species. A more careful examination, however, would show the same arrangement of dots and spots as in the normal form. Sometimes this change of color takes place a little before the insect enters the chrysalis state, although not always so, for we have had them transform without such change of tints, and at other times we have found larvæ not much more than half grown with all the dark hues above referred to, but, as already mentioned, these latter have usually been found later in the season. J. A. Lintner, Esq., of Albany, N.Y., states, in the proceedings of the Entomological Society of Philadelphia, vol. 3, p. 663, that he has noticed the caterpillar previous to this change of color, to pass with its mouth over the entire surface of the body, even to the tip of the horn, covering it with a coating of apparently glutinous matter, the operation lasting about two hours.

This larva is very destructive to the foliage of the vine, and is becoming in our neighborhood every year more troublesome. Its appetite is enormous, one or two, when nearly full grown, will almost strip a small vine of its foliage in two or three nights. Harris in his "Insects injurious to vegetation," referring to this caterpillar, says, that "they are not content with eating the leaves alone, in their progress from leaf to leaf down the stem, they stop at every cluster of fruit, and either from stupidity or disappointment, nip off the stalks of the half grown grapes, and allow them to fall to the ground untasted. I have gathered under a single vine, above a quart of unripe grapes thus detached during the night by these caterpillars." As far as our experience goes, we have never seen nor have we ever heard of their manifesting this evil disposition towards Canadian fruit growers—mayhap their manners have improved in this respect within late years.

The most effectual way of getting rid of these creatures, where their numbers are sufficient to prove troublesome, is to pick them off the vines by hand and kill them. Their destructive efforts are so painfully apparent, that their exact whereabouts is not usually difficult to determine. Sometimes where the foliage is dense, they may be more readily tracked out by observing their large dark brown castings, which strew the ground under their places of resort. But nature has provided a remedy in the shape of a minute parasite, which, tiny as it is in size, is an effectual check to the unlimited increase of this injurious insect. It is a small ichneumon fly, represented in Fig. 35. The larger drawing is a magnified view, the smaller is of the natural size. This apparently puny insect is a great friend to the vine grower, especially in many parts of the United States. Mr. Lintner of Albany, N.Y., thinks that nine-tenths of the larvæ in his vicinity are destroyed by it, and Mr. Riley of St. Louis, Mo., believes that the proportion there would reach three in four.

FIG. 35.



Color—black.

This little friend punctures the skin of the caterpillar and deposits her eggs underneath where they soon hatch into young maggots, which revel on the fatty portions of the body of their victim, until they are full grown. Mr. Lintner says, "it is usually after the last moulting, while to all appearance the larva is uninjured and thriving, that numerous little heads may be seen forcing their way through the skin of its back and sides. Within an hour's time, the entire brood of grubs have emerged. With their terminal segment remaining in the opening made by the escape of their bodies, they at once commence building about themselves small firm snow-white cocoons, which standing on end, are usually so abundant as to cover the entire body in a couple of hours. In about

a week the parasite is developed—escaping from its cocoon by pushing open a nicely fitting lid." The caterpillars infested by these parasites, manifest extraordinary vitality. One would think that the presence of such a host of comparatively large voracious creatures consuming the internal portions of the body, would naturally produce sickness and premature death; but such is not the case. Mr. Riley in the second of his excellent reports on the insects of Missouri, states that "while one of these caterpillars in its normal and healthy condition, may be starved to death in two or three days; another that is writhing with its body full of parasites, will live without food for as many weeks. Indeed, I have known one to rest for three weeks without food, in a semi-paralyzed condition, and after the parasite flies had all escaped from their cocoons, it would rouse itself and make a desperate effort to regain strength by nibbling at a leaf which was offered to it."

But no larva thus infested ever reaches maturity—they invariably die. Fig. 36 is a faithful representation of one of the caterpillars with its crop of cocoons of the parasite, ripening on its surface. From the shape and color of these cocoons, they are sometimes erroneously supposed to be the eggs of the caterpillar, and hence

FIG. 36.



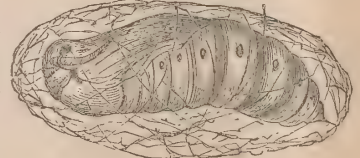
Color—White.

pains is taken to destroy the very thing that should be cherished; thus showing the great necessity there is for the diffusion of more correct ideas regarding these subjects among the people generally. This friendly parasite has, we are happy to say, established itself in the neighborhood of London; and this summer, we have seen for the first time, one of the larvæ of this common grape vine sphinx, almost entirely covered with its little snowy white cocoons. We have not been able to ascertain how far it prevails in other parts of Canada.

When the caterpillar has attained its full size, and provided also it is free from ichneumons, it descends from the vine and draws loosely together a few leaves, binding them with silken threads—generally about or near the base of the vine on which it has fed, and in this rude structure undergoes its next change.

After remaining some two or three days in a state of quiet, the body meantime growing shorter and thicker, a rent occurs in the caterpillar's skin along the back, and a pale yellowish chrysalis appears, which works itself by wriggling motions entirely out of the skin, which contracts as it is thrown off—remaining at the close of the operation, as a small shrivelled mass attached slightly to the posterior extremity or hanging to some of the adjoining silken threads. In a day or two the chrysalis grows darker in color, becoming pale brown with numerous black dots sprinkled over its surface. Along each side is a row of prominent oval black spots, which are the breathing holes or stigmata—a good representation of this chrysalis is given in Fig. 37.

FIG. 37.



Colors—Yellowish and Brown.

The perfect insect which in due time bursts the bonds of this death-like sleep, appears in a beautiful garb of green. It is a moth belonging to the family of Hawk moths, so called from their habit of hovering in the air while taking their food. The various mem-

FIG. 38.



Colors—Olive Green and Grey.

bers of this family are furnished with a slender proboscis, which when at rest, is coiled up underneath the breast, but can be extended at will, and thus when poised in the air over a flower, the slender tongue is thrust to the bottom and the sweets secured.

The wings of this insect, Fig. 38, when fully expanded, measure about two and a half inches—their form is long and narrow. The anterior pair are of a dark olive green color, crossed by bands and streaks of greenish grey, and shaded on

the outer margin with the same. The hind wings are dull red, with a patch of greenish grey on that part of the hinder margin nearest the body—shading gradually

into the surrounding tint—on the underside, the red appears on the fore wings, the hinder pair being greenish-grey. The antennæ or horns, are dull white above, with a rosy tint below. The head and shoulder covers are deep olive green, and the remainder of the body of a much paler shade of green—underneath the body is dull grey.

This moth remains quiet during the day time taking wing at dusk; when it is extremely active. Its flight is very swift and strong, and its muscular structure so powerful that when captured, it will almost beat itself to pieces by its perpetual fluttering. It is very generally distributed throughout Ontario, more abundant in the western portion. We have not been able to hear of its occurrence in Quebec.

No. 2.—THE BEAUTIFUL WOOD NYMPH (*Eudryas grata*, Fabricius).

This species also in the larva state, is destructive to the foliage of the vine. The accompanying wood engraving so admirably delineating this lovely moth and its caterpillar, is the work of Mr. Charles J. Beale, of London, Ontario, who has drawn and engraved it from nature. This moth when its wings are expanded, measures about one and three-quarter inches. Its fore wings are creamy white, with a glossy surface, with a wide brownish purple stripe along the anterior edge, reaching from the base to a little beyond the middle of the wing. On the outer margin is a broad band of the same hue, widening posteriorly, with a wavy white line running through it, composed of minute pearly dots or scales. It is also bordered internally with dull deep green. Besides this, there is a continuation of the brownish purple band along the hinder edge, but much narrower and terminating a little before it reaches the base. There are also two brown spots, one round, the other reniform, near the middle of the wing, often so suffused with pearly white scales as to be indistinct above, but clear and striking on the under-

side. The hind wings are reddish yellow, with a broad

FIG. 39.



Colors—Moth Creamy White and Brownish Purple.

brownish purple band along the outer margin, extending nearly to the outer angle, and powdered here and there with a few whitish pearly scales. There is also a faint dot on the middle of the wing, which is reproduced in a more prominent way on the under side. The under surface of both wings is reddish yellow. The head is black and there is a wide black strip down the back, merging into a series of spots of the same which extend nearly the whole remaining length of body. The sides of the body are reddish yellow, with a row of blackish dots along each side close to the under surface. The shoulder covers are white, so also is the under surface of the body.

The moth appears with us on the wing early in June, when it may often be found in the day time fast asleep on the under side of the leaves of the vine. When thus at rest its closed wings form a steep roof over its back, and its fore legs, which have a curious muff-like tuft of white hairs, are protruded, giving it altogether a very singular look. Soon after their appearance they begin to deposit their eggs. We have never observed these on the vine leaves, although they must be common enough, but have seen them when deposited by one of the moths confined in a small box. They were then spread over the surface, sometimes in groups of five or six, sometimes singly. The egg is among the prettiest of the many beautiful insect eggs. It is round and very flat, about one twenty-fifth of an inch in diameter, with a thickness of about one-fiftieth. Its color is yellowish or greenish-yellow, with an enclosed ring of black placed a little beyond the middle, and sometimes nearer to the outer margin. In the centre of the egg is a large nearly round dot, and at a little distance from this a circle of smaller dots, from which arise a series of from 24 to 27 raised striae, diverging equally as they approach the outer edge, and crossed by many gracefully curving lines which interlace also the spaces between.

When mature, the young caterpillar escapes from the upper part of the egg, lifting the centre and rupturing the portion placed over the black ring. In some cases we have observed the egg shell consumed by the young larva, while in others it did not appear to be touched.

They are usually solitary in their habits, but occasionally two or even three may be found on a single leaf, showing that the eggs are sometimes so deposited. At first they eat small holes in the leaf, but as they increase in size they consume all parts of it, the framework as well as the softer substance.

The full-grown larva (Fig. 39) is nearly one and a half inches long, tapering towards the head, thickening towards the posterior extremity. The head is medium sized, rounded, of an orange color, with a few round black dots and pale brownish hairs.

The body above is pale bluish, crossed by bands of orange and many lines of black. Each segment except the terminal one is crossed by an orange band, all of which are nearly uniform in width, excepting that on the twelfth segment, which is much wider. On the terminal segment there are two bands. All of these are more or less dotted with round black dots, from each one of which arises a single short brown hair. There are also, crossing each segment, six black lines, placed nearly at equal distances along each side, but with a wider space in the middle where the orange band occurs. The twelfth segment is much raised, and the terminal one suddenly sloped. The stigmata are oval and black.

The under side is very similar to the upper, marked also with orange and black. Feet and prolegs orange spotted with black.

The larva feeds on Virginia creeper (*Ampelopsis quinquefolia*) as well as on the vine, as also does the preceding species.

When full-grown it descends from the vine to seek some suitable location in which to pass its chrysalis or inactive stage, when, being without power of locomotion or defence, it would be at the mercy of any enemy which might chance to cross its path. Harris says the larva burrows its way a short distance underground, and there changes to a pupa without forming a cocoon. We have frequently had them transform in a pill-box, without earth or any other covering, and they have usually survived and produced in good time the perfect insect. Mr. Riley, in his second report, states that the larvæ have a fondness for boring into old pieces of wood, and within the chamber which they excavate change to chrysalis, and Mr. Ashton, of White Creek, N.Y., has found them frequently boring into corn cobs, which, he says, they prefer to going under ground. Hence Mr. Riley advises the scattering of a few corn cobs under the vines in summer, and the raking up and burning them in winter, as one means of destroying this insect. He also suggested to the writer, during a conversation on this subject, the idea of putting a few large corks into boxes where the caterpillars were being reared, so that they might burrow into them, and thus be better protected during the pupa state, which we found to serve an admirable purpose, they availed themselves of such shelter very readily. In two small buags about one and a half inches in diameter, and an inch thick, we found twenty-one enclosed chrysalids. The caterpillar excavates with its jaws a chamber but little larger than the chrysalis which is to rest in it. It is not lined with silk, but is made moderately smooth. This, when completed, is fastened over the top with a cap or cover, composed of minute fragments of cork formed into a sort of membrane by means of a glutinous secretion associated with threads of silk. When nicely finished its surface is slightly glossy, and the glossiness extending a little over, beyond the actual orifice, indicates that the glutinous matter has been of a thin consistence, and hence spread a little during its application. When this lid is lifted the head of the chrysalis is usually found quite close to it.

The chrysalis is about seven-tenths of an inch long, of a nearly uniform dark brown color, roughened with small blackish points or granulations. The head case is somewhat conical; the thorax and middle segments nearly cylindrical, while the posterior segments are tapering, the terminal one having a pair of long tubercles above, and a pair of shorter ones below.

We incline to the opinion that this moth is sometimes double-brooded; we have reared the perfect insect repeatedly from caterpillars of the current year, and we have found the larva in various stages of growth quite late in the season.

This species is also subject to the attacks of a parasite, although a very different one from that which we have referred to as infesting *pampinatria*. This is a dipterous or two-winged fly, a Tachina, and we believe it to belong to the species known as the red-tailed Tachina fly, *Exorista leucania*, (Fig. 40). This fly is not unlike the common house fly in

appearance, and is about one-quarter of an inch long, with a white face, large reddish eyes, a dark hairy body, with four, more or less distinct, dark lines down the thorax, and patches of a greyish shade along the sides of the abdomen. We have reared several specimens of this fly from the larva of *Eudryas grata* during the past season. Their mode



FIG. 40.

of procedure is as follows:—The parent fly deposits her eggs on the back of the caterpillar, usually a short distance behind the head, where they are cemented firmly by means of a peculiar secretion with which the insect is furnished. Three or four of these eggs are usually placed upon a single caterpillar, where, after a few days, they hatch, and the tiny grub eats its way through the skin into the interior of the body, where it feeds upon the fatty matters, avoiding the vital organs which are essential to the continuance of the life of its victim. When the caterpillar is about full-grown it dies, and from its body proceed these three or four full-

grown whitish grubs, which, soon after their escape, change to chrysalids. These are nearly one-fifth of an inch long, oval, smooth, and of a dark brown color.

This friendly parasite materially assists in keeping down the numbers of these and several other kinds of caterpillars, which would otherwise be a source of much greater annoyance to the fruit grower.

Eudryas grata is generally common throughout both the Provinces of Ontario and Quebec. Mr. G. J. Bowles, of Quebec, says that it is not uncommon there, and that the larva feeds on the hop, appearing in June and July. We believe this fact of its feeding on the hop has never been noticed before. Rev. L. Provancher, editor of *Le Naturaliste Canadien*, Quebec, also speaks of it as abundant, sometimes so numerous as to be quite destructive to the foliage of the vines. Mr. D. W. Beadle, of St. Catharines, says it may generally be found every season on his grounds, but not in sufficient quantity to do much harm. Mr. J. Petit, of Grimsby, bears similar testimony as to its presence there. On our own vines we have found them, especially during the past season, quite numerous, so much so that where they were disregarded they soon materially disfigured and damaged the vines. As remedies, we would suggest hand-picking and syringing the vines with hellebore and water.

No. 3.—THE PEARL WOOD NYMPH (*Eudryas unio*, Hubner). This is a near relative of "*grata*," the beautiful Wood Nymph, indeed, so nearly do they resemble one another that it requires the practised eye of an Entomologist to distinguish between them. This moth, however, is a little smaller, its wings expanding about one inch and three-eighths, and also differs in the following points:—On the fore wings, the brownish purple stripe on the front margin is extended further along the wing, the bordering of the outer margin is paler and more uniform in width, the inner edge wavy instead of straight, and the bordering of the hinder margin is wider and more distinct. The edging of the hind wings is much paler, and extends the whole length of the outer margin.

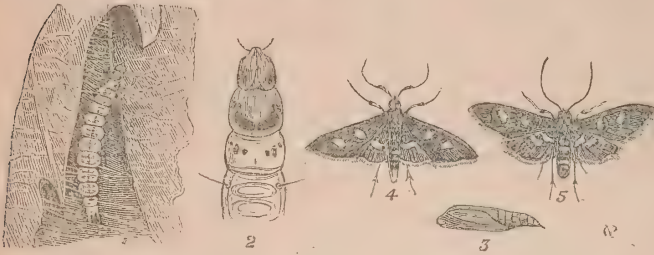
With us this insect is much less common than *grata*, and we have no personal acquaintance with its larval history, but it is said to resemble its relative in this state almost as closely as in the perfect one. Mr. Riley says "it never grows to be quite as large as the other, and may be readily distinguished by its more decided bluish cast, by having but four light and four dark stripes to each segment, by having no orange band across the middle segments, and by the spots, with the exception of two on the back, placed in the middle light band, being almost obsolete. The head-shield on the first segment, hump on the 11th, and a band on the 12th, are orange, spotted with black; venter orange, becoming dusky towards the head, feet and legs also orange, with blackish extremities, and with spots on their outside at base."

"The worm works for the most part in the terminal buds of the vine, drawing the leaves together by a weak silken thread, and cankering them. It forms a simple earthen cocoon, or frequently bores into a piece of old wood, and changes to chrysalis, which averages but .036 inch in length. This chrysalis is reddish brown, covered on the back with rows of very minute teeth, with the tip of the abdomen truncated, and terminating above in a thick blunt spine on each side.

This moth is very rare throughout Ontario, and we have been unable to learn of its occurrence at all in Quebec, so it is scarcely likely it will ever be the cause of much annoyance.

No. 4. THE GRAPE-VINE LEAF ROLLER (*Desmia maculalis*, Westwood.) This species, although most abundant in the Southern States, is still very generally distributed, and will no doubt, in its caterpillar form, be familiar to all vine-growers. The accompanying

FIG. 41.



Colors—1 and 2 grass green, 3 brown, 4 and 5 black and white.

its body being nearly four-tenths of an inch long. Its wings are dark brown, nearly black, with a bronzed or coppery lustre, and lightly fringed with white. The fore wings have two white, nearly oval, spots, the hind wings but one white spot, which is usually larger than either of those on the anterior pair; sometimes in the female the spot is slightly divided. The under side of the wings is very similar to the upper, but of a duller shade. The body of the male is also nearly black, with one white band, while the female has two.

There are two broods of this insect during the summer. The first moths—which have passed the winter in the chrysalis state—appear early in June; the second brood in August. They deposit their eggs singly on the leaves of the vine. Soon after the young worm is hatched, it begins to manifest its leaf-folding propensities, by turning down a small portion of the leaf on which it is placed, and living within the tube thus formed. As it increases in size, a larger case is made, often the whole leaf is rolled over and over into a large cylinder, wider at one end than the other and firmly fastened with stout silken threads. In this the little active wriggling creature lives, its case affording it a tolerably safe hiding place, from whence it issues forth to feed on the surrounding foliage. It is so very rapid in its movements both backwards and forwards, that it frequently escapes detection, by suddenly slipping out of its case when disturbed and falling to the ground. The first brood of caterpillars are full grown about the last of July—the second in the beginning of September.

The length of the full grown larva is about three-quarters of an inch—its body cylindrical, that is of the same thickness throughout. The head is medium sized, dull reddish yellow, with a faint streak of black on each side near the base, and a few very fine yellow hairs. The mandibles are tipped with brown.

The body is yellowish green at the sides, a little darker above, glossy and semi-transparent with a few fine yellow hairs on each segment. The second segment—that is the first behind the head—has a crescent shaped patch above, of the same color and appearance as the head, covering nearly the whole of its upper surface and edged behind with brownish black. The third segment has three spots on each side, the two lower of which are sometimes united, forming a single reniform patch of black—the upper one which is smaller, is of a pale brown color. The twelfth segment has also a black spot on each side, and is a little paler in color above than the other segments are. The under surface is pale greenish yellow, with the same glossiness and semi-transparent appearance as the upper surface—the feet and prolegs partake of the general color.

Before entering the chrysalis state, Mr. Riley says they change color, assuming a pink shade. The chrysalis is about half an inch long and of a dark brown color. It is usually formed within the fold of the leaf, so the last brood which passes the winter in this inactive state, may in a great measure be destroyed by carefully going over the vineyard late in the season, before the leaves fall, and picking off the folded leaves and burning them, or the larva may be destroyed earlier in the season, by suddenly crushing the folded leaves

wood-cut (Fig. 41) represents the moth with its wings closed and expanded, the larva of its natural size, also a magnified view of a portion of the anterior part of its body, and the chrysalis.

The moth is a very pretty little creature. Its wings when expanded measure about nine-tenths of an inch,

with both hands. In our own experience we have oftener found the cases empty than occupied, but whether this arises from their destruction by birds or other enemies, we have not been able to ascertain—spiders are said to kill many of them. We have never met with or heard of, any parasite attacking this species.

This insect, we learn from Messrs. Bowles and Provancher, is common about Quebec, where as the grape is not much cultivated, it probably feeds on the wild vines. It is also plentiful throughout Ontario, although nowhere as far as we can learn is it very destructive.

No. 5. THE GRAPE-VINE PLUME.—(*Pterophorus periscelidactylus*—Fitch.)

This although an extensive name is applied to quite a small insect. The moths belonging to this family are called plume moths, from the fact of their having their wings divided into feather like lobes, and the English rendering of the above extremely formidable looking scientific name, would be "the Gartered Plume"; so designated from the circumstance of having its hind legs surrounded near the joints, with garter like tufts of brownish scales.

As soon as the young branches of the grape vine have fairly started, and just about the time when the third bunch of blossom is appearing, this enemy to its growth appears with it, in the shape of a small whitish hairy caterpillar, fastening the young terminal leaves into a ball shaped mass, and living within the hollow sphere thus formed. The caterpillars are generally found solitary, hence it is probable that the eggs are laid singly. Mr. Riley says "that the very young larva is smooth and nearly destitute of hairs, but after each moult the hairs become more perceptible, and when full grown, appear as at Fig. 42," *a*. We have not seen the caterpillar while very young, but have been painfully

FIG. 42.



exercised in observing its destructive work, when near its maturity.

It is then about half an inch long and cylindrical in form. Its head is small, of a yellowish green color, with a band of black across the front, just above the mandibles, and a few fine greenish hairs scattered over its surface. The mandibles are faintly tipped with brown.

The body above is yellowish green, with transverse rows of dull yellow tubercles, from each of which arises a small tuft of white hairs. There is a line down the back of deeper green, and the body is a little paler between the segments.

The under surface is somewhat deeper in color than the upper, with a few whitish hairs. The feet are black, tipped with yellowish green—the prolegs which are long and thin, are of a greenish color.

Sometimes the caterpillar assumes a pinkish hue before entering on its next stage of life, but more commonly it retains its normal color. It may usually be found full grown from the eleventh to the fifteenth of June, but this year they were about two weeks earlier.

When matured, it spins a few silken threads on the under side of a leaf, or in some other convenient spot, and having entangled its hind legs firmly in the web of silk, it

sheds its hairy skin and becomes a chrysalis; which as it escapes from the larval covering hangs itself up by its posterior extremity—entangling the little hooks with which it is furnished, in the same silken fibres as those in which the caterpillar's legs were fastened. How it does this without hands or feet to hold on by, would take too long to explain, but it is a most marvellous feat, performed but once in the creature's life, hence without previous instruction or practice, and scarcely ever with a mishap.

The chrysalis (Fig. 42, *b*), is an odd looking little thing about four tenths of an inch long, angular and rugged, and wriggles about very briskly when touched. At first it is of a pale yellowish green, but soon grows darker on the summit of the anterior extremity, and on the more prominent protuberances. The deepening in color is gradual, finally extending over the whole surface, when it becomes reddish brown, sometimes yellowish

Colors—(*a*) White, (*b*) Light brown,
(*d*) Tawny yellow.

brown. The head case is nearly black, with a rugged surface—the anterior segments almost cylindrical, with a ventral depression or cavity, ridged on each side to about the beginning of the seventh segment, where the ridging terminates in a pair of dark protuberances. The posterior segments are tapering, and there is a slightly darker ventral line, with a row of small tubercles on each side.

Dr. Fitch, State Entomologist of New York, who was the first to describe and name this insect, says that the duration of the chrysalis state, is only from six to eight days. Mr. Riley puts it down as a week. Our own observations, which have been very carefully made, point to a longer period, not less than ten days, and not usually more than thirteen, most commonly about twelve days.

The elegant little moth (Fig. 42, *d*.) then makes its appearance. Its wings, which are very finely and delicately constructed, measure, when expanded, about seven-tenths of an inch. The fore wings are long and narrow, and cleft down the middle, about half way towards their base; the posterior half of the wing having a notch in the outer margin. Their color is yellowish brown, with a metallic lustre, with several dull whitish streaks and spots. The hind wings are divided into three lobes, the lower division is complete, extending to the base, the upper one only about two-thirds of the distance. The color of these is yellowish brown also, with the same burnished metallic appearance, and with a streak of dull white on the hinder lobe. The outer and hind margins of the wings, as well as all the edges of their lobes, are beautifully bordered with a deep whitish fringe, sprinkled here and there with brown. Its body is long and slender, and of the same color as the wings, but a shade darker. The antennæ are moderately long and thread like, nearly black, but beautifully and regularly dotted with white their whole length. The legs are also long, banded alternately with yellowish brown and white, and powdered with metallic scales. The hinder ones are each furnished with two pairs of diverging spines, having at their base a garter-like tuft of long brown scales.

Under a low magnifying power, this moth is really a charming object, we have scarcely seen a more beautiful one. Its graceful outlines, its delicate structure and the harmonious blending of its soft shades of color, with the light reflected from its burnished coppery-like scales—all enchant the eye, and to think that such grace of form and beauty of detail should spring from such a common looking hairy caterpillar, lends a further interest to it.

With regard to its manner of flight, we cannot do better than quote Dr. Fitch:—“Like other species of this family, this moth is very agile, rapid, and impetuous in its motion. When disturbed, bounding from side to side of the cage in which it is confined, almost with the velocity of lightning, for a moment, and then resting; clinging with its four anterior feet to the top of the cage, its wings spread and its body hanging perpendicularly downwards, and swinging to and fro with the wind, with its long hind legs extended.”

In all probability there is only one brood of this insect during the season. Where a species is double-brooded, the second brood is usually more numerous than the first, but in this case, although specimens of the early brood are only too plentiful, we have failed after close observation for two seasons, to see any indications of later offspring. May it not be that the moth which appears from the middle to the end of June, deposits its egg on the canes of the vines, near the base of the bud from which the next year's branch will spring, and that there it remains quiescent during the remainder of summer, and following winter, hatching into the larva in spring? Further investigation here is needed.

The spinning habits of this creature, lead to its ready detection, when it may be easily crushed with the hand, consequently where ordinary care is exercised, its destructive powers are not likely to cause serious alarm.

This species is also widely distributed. Rev. L. Provancher says it is common in the neighborhood of Quebec, and it is pretty generally scattered throughout Ontario.

No. 6.—THE GRAPE OIDARIA (*Cidaria diversilineata*, Hubner). This is a pretty yellow moth with brown lines, producing a geometric or looping caterpillar, which consumes the foliage of the vine. In the August number, 1870, of the *Canadian Entomologist*, we published the results of our observations on this insect during the past season, which we shall here make free use of.

In early spring, just when the grape blossoms were fairly open, while pinching in the rapidly growing branches of a vine, a blossom bunch attracted attention by its unusual appearance. A closer inspection showed that part of the bunch had been eaten away, and the remaining portions drawn together by light silken threads, and within the enclosure was a dull brown caterpillar, with its body much contracted, and just ready to assume the chrysalis state. The bunch was removed from the vine and enclosed in a small box, when in a day or two afterwards the change of form took place. The chrysalis was six-tenths of an inch long, and of a pale reddish brown color. In about ten days afterwards it produced the perfect insect which proved to be *Cidaria diversilineata*. These observations disclose an interesting fact regarding the history of this insect, which is that it passes the winter, sometimes if not invariably in the caterpillar state, hibernating in some secure retreat, where it sleeps peacefully till called again into activity by the genial warmth of spring, when in a few days it flushes its growth and effects its changes as already described. The accompanying figure illustrating this insect, is also the work of Mr. Charles J.

FIG. 43.



Color—Larva, yellowish green—
Moth pale ochre yellow.

Beale, of London, Ontario, who has drawn and engraved the moth from nature—the larva is copied from Packard's Guide to the Study of Insects.

This moth (Fig. 43) measures, when its wings are expanded, about one and a half inches. Its color is pale ochre yellow, crossed by many greyish brown lines, and clouded also with patches of the same, particularly along the margin of the wings. The under side is a little paler than the upper, with fewer and fainter lines, but bordered along the outer edges, much the same as above. The body and legs are similar in color to the wings, the legs being marked with black about the joints.

On the 7th of June a number of reddish geometric caterpillars were found on the vine leaves, in which they had eaten innumerable holes of various shapes and sizes; these proved to belong to the same insect. At this time (see Fig. 43), they were about an inch long. The head was rather small, flattened in front, and bilobed, each lobe projecting above and terminating in a point. Its color was dull brownish green, and the mandibles were tipped with reddish brown.

The body above was dull yellowish green, with a reddish or pink tinge, the second segment pale yellowish green, smooth, and very similar in appearance to the head, but larger. The third, fourth, eleventh, twelfth and thirteenth segments were also pale yellowish green, but the middle segments had a decided pinkish tinge. The surface of the body was wrinkled, and the terminal segment furnished with two short greenish spines, which extended backwards over the anal lid.

The under surface was similar in color to the upper, with a double whitish line down the middle. The feet were pinkish, and the thick fleshy prolegs green.

Many variations in color were observed in different specimens of this larva. One which answered the description given above, on the 7th, changed its skin on the morning of the 8th, and appeared in a garb of very dark brown, nearly black, with longitudinal lines of a paler brown. A younger specimen was yellowish green, with the head very large and prominent. Another, older one, was bright deep red above, with a wide broken band of dull green down the middle of the under surface, without any appearance of the double whitish line so prominent in most of the others. A fourth, about the same size, was dull whitish green, with the whitish lines below also wanting.

A full-grown caterpillar, found on the 10th June, measured one and a quarter inches. Its head was dull reddish brown, the body above yellowish green, as in the former description, but with a few very small whitish dots on each segment. On each side of the second segment was a small reddish spot, and on the third a larger one of a darker shade, and on this latter segment the folds of the skin protruded, making the spot appear like a brown prominence. The spaces between the middle segments were yellowish white, excepting one or two of the terminal ones, which were dull brown. In other respects it answered to the previous description.

The under surface had a reddish hue, and a central dull reddish line, bordered on each side by a faint white stripe, edged again without by dull red. The feet were reddish, with the spaces between them yellowish green. On the 11th of June the larva fastened itself up in a leaf, preparing for its next change.

During the middle of August fresh looking specimens of the moth were taken again on the wing.

From the preceding facts the following summary of the history of this insect may be given:—The larva, which had hybernated during the winter, entered the chrysalis state in early spring, which produced the moth about ten days afterwards. The moths, during the next few days, pair and deposit their eggs on the foliage of the vine, which hatch into small caterpillars early in June. During this month they attain their full size, pass through the chrysalis state, and appear as moths again in August. These latter deposit the second crop of eggs, from which the larvæ are again produced, which attain nearly full growth before winter, and pass that inclement season in a state of torpidity.

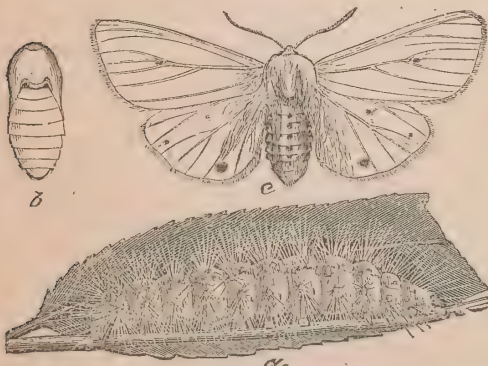
Where their numbers are sufficient to prove troublesome, we can only suggest as remedies the measures already so often adverted to, viz., syringing with hellebore and water, and hand-picking. This insect is also found on the Virginia creeper (*Ampelopsis quinquefolia*.)

Although very generally distributed, the Grape Cidaria seldom appears in sufficient numbers to cause alarm; like most other insects, they are much more plentiful some seasons than others. Mr. Bowles, of Quebec, informs us that they were very common in his vicinity several years ago, but have been comparatively rare since. D. W. Beadle says they are seldom seen about St. Catharines. In our own neighborhood we rarely pass a season without seeing a good number of them.

No. 7.—THE COMMON YELLOW WOOLLY BEAR (*Spilosoma virginica*, Fabricius). This insect is so well known in the caterpillar state, that it scarcely needs any description; any one who has had a garden in which fruits or flowers of any sort have been grown, must have become familiar with the yellow Woolly Bear, for, of all caterpillars, none are so common or so uniformly troublesome. They seem to have an especial liking for the grape, but are not at all particular, for if they cannot get vine leaves, they will take almost anything else green, and thrive on it.

The moth from which the larva is produced is shown in Figure 44, where the caterpillar and chrysalis are also figured.

FIG. 44.



Color—(a) yellow or brown; (b) shiny brown; (c) white, black and orange.

and by this time their appetites and digestive powers have become so good that they can, and do, eat freely all parts of the leaf.

The full-grown caterpillar, Fig. 44 (a), is nearly two inches long, and usually of a yellowish color, but not always so, for they vary greatly in the tint of their hairy covering. From the same brood may be found some yellow, some straw color, others light brown, and some even very dark brown, but the yellow is by far the most common color. The head and feet are usually yellow, and the hairs arise in little tufts from small yellow tubercles, arranged nearly in rows across the body. In the spaces between the segments

pillar and chrysalis are also figured. The moth is commonly known as the "White Miller." It passes the winter in the chrysalis state, and appears on the wing early in May, depositing its round yellow eggs on the under side of the leaves in large clusters. These, in a few days, hatch into young hairy caterpillars, which feed for a time in company, devouring, at this tender age, the under side of the leaf only, which is less tough than the upper; the skin over the eaten parts soon becoming yellow. It is not for long that their powers for injury are so limited. When they have a little more growth, they part company with their fellows, each one choosing his own course, and living to himself,

or rings there are darker lines, sometimes brown, at others dark brown, nearly black; there is a line of the same along each side, and the under surface of the body is dark also.

When the caterpillar is full grown, it seeks some sheltered nook in which to change to chrysalis. Some hole in a fence post, or other hole and corner place in fence, house, or wood pile, wherever it is dry and secluded. We once found one snugly hid in the middle of a cluster of grapes. After a little wandering about and consideration, they fix on a suitable locality, and proceed to divest their bodies of their covering of hairs, and with these woven together with silken threads, they construct the slight enclosure which is to shelter the chrysalis. Here the change takes place, the chrysalis (Fig. 44, *b*) being of the usual brown color, and after a week or two, the perfect moth makes its appearance, to deposit fresh batches of eggs, from which in a few days is hatched the second brood of larvæ, which pass through the different stages of their growth, and enter the chrysalis state before the time of winter.

The moth (Fig. 44, *c*) measures, when its wings are extended, from one inch and a half to two inches. The males are smaller than the females—it is a female which is figured. Both sexes have the wings white with a few black dots, which vary very much in number in different specimens; in some there are two on each of the front, and three on each of the hind wings as in the figure; in others again the spots are almost entirely wanting, and there is every degree of macular gradation between the two extremes. We believe, however, that the dot near the middle of the front wings is always present, but sometimes very faint. The underside usually has the spots more distinct than the upper one, and sometimes there is a slight tinge of yellow over its white surface. The antennæ are white above, dark brown below, the head and thorax white, while the abdomen is orange colored, sometimes streaked across with white, and having three rows of black spots, one above and one on each side. The under side of the abdomen is white, sometimes tinged with orange.

This species is subject to the attack of several kinds of parasites, which destroy immense numbers every year; were it not for this we should soon be overrun with them. With all these checks they are at times very numerous and destructive, and we have to resort to hand picking to destroy them. The process is tedious enough, but it is sure, and we do not know of a better.

With regard to their geographical distribution, we think we are safe in saying, as far as Canada is concerned, that they may be found every summer everywhere.

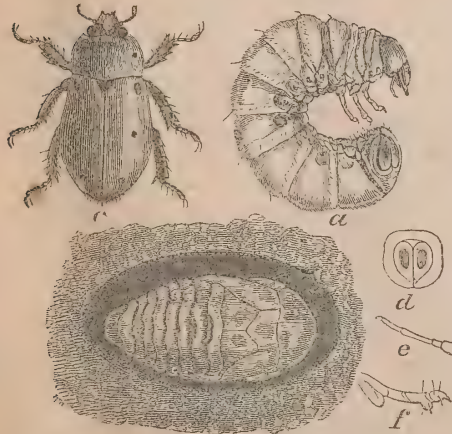
Having now gone through with the history and habits of the most prominent of the moths injurious to the vine, we shall devote some space to the destructive insects belonging to the other families.

No. 8. — THE SPOTTED PELIDNOTA (*Pelidnota punctata*, Linnaeus). The accompany-

ing excellent figure represents this insect in its three stages of larva (*a*), chrysalis (*b*), and beetle (*c*). It is in the latter state only that it is injurious to the vine—consuming the foliage. It eats numerous holes in the leaves, sometimes where the beetles are very numerous completely riddling them.

The beetle is a large one, measuring about an inch in length, and, at its widest part, half an inch in width, and nearly oval in form. Its color is dull reddish yellow, or nearly leather color, with a polished surface. The thorax, which is very slightly darker than the wing covers, has a small black spot on each side; and there are three larger ones on each wing case. The jaws and posterior part of the head are both black, and so also is the scutellum, which is a small nearly triangular piece, placed near the centre above, and just where the two anterior edges of the wing cases join the thorax. The gauze-like wings concealed under the

FIG. 45.



Color—(*a*) glossy white; (*b*) yellowish; (*c*) reddish yellow, with black spots.

wing cases are dark brown. The under surface is of a dark green shade, with a metallic lustre, and somewhat downy about the middle with fine brownish hairs; its legs are of the same dark shining green.

It appears in July, August, and sometimes in September, and is active in the day time flying about from vine to vine, with a loud buzzing noise. After the insects have paired, the female deposits her eggs in rotten wood, which, when the young grub is hatched, furnishes it with suitable food for its development. Mr. Riley, who was the first to find the larva and rear it, gives in the *American Entomologist*, vol. 2, p. 295, the following description:—"It is a large clumsy grub, bearing a close resemblance to the common 'white grub' of our meadows, and differs from that species principally in being less wrinkled, and in having the skin more polished and of a purer white color, and in the distinct heart-shaped swelling above the anus, Fig. 45 (d). Towards the latter part of June, we have found this larva, Fig. 45 (a), in company with the pupa, Fig. 45 (b), in rotten stumps and roots of the pear. In preparing for the pupa state, the larva forms a rather unsubstantial cocoon of its own excrement, mixed with the surrounding wood. The pupa state lasts but from eight to ten days, and the beetle, Fig. 45 (c), is found on our vines during the months of July, August and September. It is not yet known how long a time is required for the development of the larva, but from analogy, we may infer that the insect lives in that state upwards of three years."

Fig. 45 (e) shows the antennae of the larva, and (f) one of the legs—both magnified.

This foe, as far as we can learn, is confined in Canada to the Province of Ontario, and prevails chiefly in its western section. According to Messrs. Provancher and Bowles, it is never found about Quebec. Even in the places in which it most delights to dwell, it is not generally a very troublesome enemy. Should they at any time be present in sufficient number to create alarm, they may be materially lessened by hand picking and crushing under the foot. They are heavy and clumsy in their movements, and not difficult to capture. They feed on both wild and cultivated vines, and also on the allied Virginia creeper (*Ampelopsis quinquefolia*).

No. 9.—THE GRAPE VINE FLEA BEETLE (*Haltica chalybea*, Illiger). The common name of this insect suggests activity, and it is equally active in mischief as in movement, hopping from leaf to leaf, and from branch to branch, with a celerity scarcely surpassed by its smaller namesake.

This beetle survives the winter in the perfect state, lying dormant and torpid under leaves, pieces of bark, or other suitable shelter, until called into activity by the reviving warmth of spring. It is a pretty little beetle (Fig. 46), of a polished steel blue or green color, sometimes shading into purplish, with a transverse depression across the hinder part of the thorax. The under side is dark green, the antennae and feet brownish black. Its length is about three-twentieths of an inch, and it has stout, robust thighs, by means of which it is able to jump about very briskly; these are well shown in the figure. It is more destructive in spring than at any other time; for then, before the buds have burst, this creature is astir, with appetite the keener for its long winter fast; and while the tender growth is swelling, and displaying its lovely roseate tints, this little mischief-maker pounces on it, and hollows it out to its centre, thus consuming, in a short time, two or three embryo bunches of grapes.



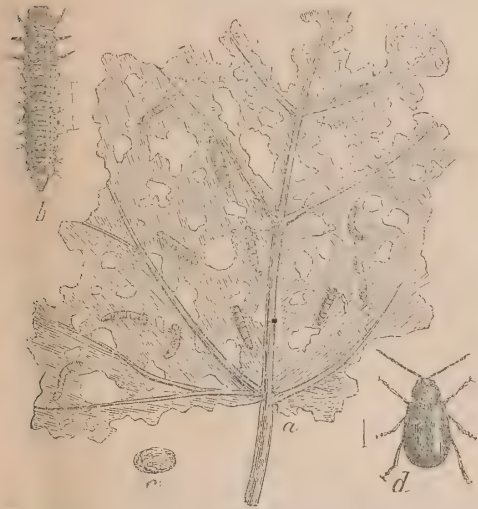
Its first appearance, as a destructive agent, is noted by Mr. Thomas, of Cayuga Co., N. Y., in 1831, in a communication to Silliman's "American Journal of Science and Art." "These brilliant insects," Harris says, "were observed by him in Cayuga Co., N. Y., "creeping on the vine and destroying the buds, by eating out the central succulent parts. "Some had burrowed even half their length into the buds. When disturbed, they jump, "rather than fly, and remain, where they fall for a time without motion. During the "same season, these beetles appeared in unusually great numbers in New Haven, Conn., "and its vicinity, and the injury done by them was wholly unexampled. Some vines "were entirely despoiled of their fruit buds, so as to be rendered, for that season, barren." Mr. Thomas found the vine leaves infested in the year 1830 and 1831, by small chestnut-colored, smooth worms, and suspecting them to be the larva of the beetle, he fed them in

a tumbler containing some moist earth, until they were fully grown, then they buried themselves in the earth. After a fortnight or so some of the beetles were found in the tumbler. Hence there is no doubt that the former were the larvæ of the beetles, and that they undergo their transformations in the ground.

Previous to the time when this communication was made, they were confined chiefly to the wild vine and the Virginia creeper, both of which they fed on, but since, they have spread nearly all over the United States and Canada, and in many places have proved very destructive. Mr. J. Kirkpatrick, in "Field Notes," says that, in 1865, the crops of several vineyards in the northern part of Ohio were entirely destroyed by it, and that the same painful experience fell to the lot of some of the vine-growers on the shore of Lake Erie.

The beetles appear on the vines in the latter part of April, and continue to be destructive till late in May, after which they gradually disappear. Before leaving, however, they deposit orange colored eggs in clusters on the under side of the young vine leaves, which hatch in a few days into small, dark brown worms, which feed on the upper side of the leaves, eating numberless holes in the softer parts, Fig. 47 (a).

Fig. 47.



Colors—(b) Shining brown and black; (d) steel blue, or metallic green and purple.

raises it suddenly behind, as do some of the geometers or loopers.

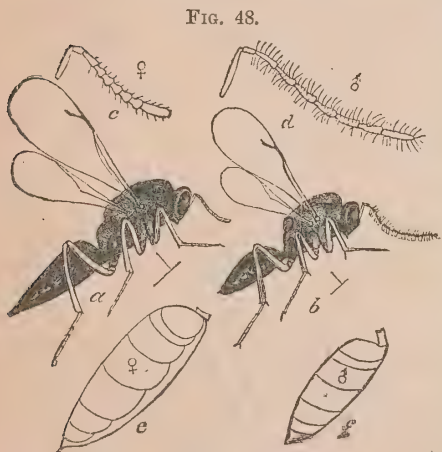
In the early part of June, the larvæ leave the vines, and descend to the ground, where they burrow under the earth, and forming a little smooth, oval cell, change to a dark yellowish chrysalis, Fig. 47 (c). After remaining about two or three weeks in this state, the perfect beetles issue from them and the work of destruction goes on again; but as they live altogether on leaves during the fall, of which there is usually an abundance, the amount of injury done is much less than in spring. Mr. Kirkpatrick states that there are several broods during the season, but Mr. Riley thinks there is only one, and that the beetles which appear early in June remain over to the next spring. Some further investigations are needed to clear this matter up.

To destroy the beetles, it is recommended to strew, in the fall, air slacked lime, or a good quantity of unleached ashes, around the vines infested. Mr. Riley says the larvæ may be destroyed by blowing on them, from a bellows, fresh air-slacked lime; they are very tenacious of life, and would no doubt require a thorough application to ensure their destruction. We should also advise the use of powdered hellebore and water, mixed in the proportion of an ounce to the gallon, and applied to the foliage by means of a syringe. Strong soap suds have also been recommended, and are perhaps worthy of trial, although not likely to be so effective as the other measures referred to. During the early spring,

in chilly mornings, the beetles are comparatively sluggish and inactive, and some chance is then afforded of hand-picking and destroying them. A good quantity of fowls, allowed, at this time, the run of the vineyard, has also been tried with success. We have not heard of their being affected by any parasite.

They are much more abundant some seasons than others, which may probably be due to some atmospheric influences favorable or otherwise to the continuance of their lives. Mr. James Dougall, of Windsor, says that a few years ago they were very destructive to his vines, but within the last two or three years he has only noticed a stray one now and then. Mr. J. Pettit, of Grimsby, Ontario, states that in the spring of 1869 he saw the flea beetle in the vineyard of Mr. W. W. Kitchen, eating the buds of his vines; they were numerous, but Mr. Kitchen afterwards said they did but little harm. Mr. D. W. Beadle, of St. Catharines, says:—"I have seen it on my grounds in the perfect and larval state, but only to search it out and kill it, and now it is two years since I have seen it here." In our own locality it has never proved very troublesome, but with Mr. Ohas. Arnold, of Paris, it has been very destructive, not so much, however, of late, as it was some two or three years since. Mr. Arnold had a quantity of the Virginia creeper growing on his grounds, which he thought afforded it a convenient and undisturbed harbor. This he destroyed, and since then has not found the beetle so troublesome. We have not been able to learn of its occurrence in Quebec.

No. 10.—THE GRAPE SEED INSECT (*Isosoma vitis*, Saunders). The accompanying figure 48, although not belonging to *Isosoma vitis*, belongs to a species of *Isosoma* so closely resembling it that it would require careful scrutiny to distinguish between them, and will give a very good idea of its general appearance, as seen under a magnifying power. (a) Represents the female, (b) the male, (c) the antennæ of the female, (d) the antennæ of the male (e) the abdomen of the female enlarged, showing the segments or rings of the body, (f) that of the male. The short hair lines under the figures of the perfect insects show their natural size.



this time have occasioned great alarm. But it has wisely been ordered otherwise. Either climatic influences, or some other unseen and unknown power has been unfavorable to its continuance and propagation, so that it has almost disappeared at present from our midst; possibly the cold and wet season of 1869 has had something to do with bringing about this result. Although diligent search was made last year, we failed to find any traces of its presence; and this year our efforts in this direction have happily been equally fruitless, but we learn from our esteemed friend, Rev. R. Burnett, of Hamilton, that it has occurred in that neighborhood this summer. He says "in some bunches there would be two or three, and as high as eight or ten berries affected. I noticed the damage first by the apparent early ripening of the berries, while the others were green, with no visible appearance of maturity. The exposure these vines had was altogether in favor of the propagation of the insect, due south, under shelter from the north of an eight feet board fence. The place was warm as an oven. Nor was this the only place where the seed insect was found. I examined the vines of several of my neighbors, and found them less or more affected."

Having been unable to accumulate any new facts or details regarding its history or habits, and seeing we want to present here a complete account as far as we can of the insects found injuring the grape with us, we cannot do better than quote from our former

report to the Fruit Growers' Association of Ontario, and also from papers relating to the same subject in the *Canadian Entomologist*.

On the 20th of August, 1868, we observed that many of the berries in the bunches of a Clinton vine, under our care, were shrivelling up. On opening the grapes we observed that most of the smaller berries—that is those which had shrivelled earliest—contained only one seed, and that of an unusually large size; but some of the larger withered grapes contained two seeds, also swollen, each having a dark spot somewhere on its surface. On cutting the seeds carefully open the kernel was found almost entirely consumed, and the cavity occupied by a small, milk white, footless grub, with a pair of brown hooked mandibles, a smooth and glossy skin, with a few very fine short white hairs. When at rest it was nearly oval in form, but when in motion its body became elongated, varying in length from one-fifteenth to one-twelfth of an inch.

FIG. 49.



Figure 49 is a correct representation of this grub as it appears when magnified. The small figure underneath shows its natural size.

The parent insect probably deposits the egg on the skin of the grape, and the young larvæ as soon as hatched puncture the skin and work their way at once to the middle of the fruit, and there enter the seed while young and soft. Many of the grapes affected had a small scar, indicating probably where the insects had entered.

The Clinton vine, on which this pest was first discovered, suffered considerably; fully ten per cent. of the crop was lost from the shrivelling of the infected berries. At first we supposed that the work of the insect was confined to fruit with this appearance, and that by destroying this the destruction of the crop of insects for the season would be nearly complete; but further examination showed that many of the ripe berries contained affected seeds. The proportion thus infected on the vine referred to, was about ten or eleven per cent. Within a few feet of this an Isabella vine was fruiting, on which there were no shrivelled berries, but about three per cent. of those which had ripened contained grubs. About the same distance in another direction was a Hartford Prolific, and ten feet further off a Concord, both of which fruited well; on neither of these were there any withered berries, nor could we find any affected seeds among those which had ripened. The fruit of a Delaware, about fifty feet distant from the Clinton, was also examined without discerning any traces of the insect.

About the middle of September we visited the grounds of Mr. Chas. Arnold, of Paris, Ont., and there we found that this insect had prevailed to a greater extent than it had with ourselves, affecting the Clinton, Delaware, one of Rogers' Hybrids, and also Mr. Arnold's new seedlings. In Hamilton, in the garden of Mr. W. H. Mills, we found an affected seed in a berry of Rogers' No. 4. On the 24th September we visited the vineyard of the "Vine Growers' Association," at Cooksville, Ont., but could not find any traces of the insect there. Thus far its depredations have been chiefly apparent about London, Paris and Hamilton, but further observations may show that it is widely distributed.

Where any shrivelled berries are found, their seeds should be examined, as it is important to know how widespread this evil is. The affected seeds are usually swollen, somewhat soft, and have a dark spot somewhere on their surface; any with these characteristics noticed among the ripe berries should also be examined.

In the case of the shrivelled berries, where one seed only was affected, the others were dwarfed and imperfect, and where two large seeds were found they were both occupied. When one seed only was affected and the other remained healthy, the one normal seed carried the berry through, in an apparently healthy state, to ripeness. As far as our experience teaches, the Clinton and its allies with thin skins are more liable to attack than berries with thicker skins, such as Hartford Prolific and Concord.

In October of the same year, we found the larvæ still unchanged within the seed, so we detached one and placed it in a small glass cell between two plates of glass, so that it might not dry up from exposure to the air, and give us at the same time an opportunity of watching its progress. It remained in this state until early in January, 1869, when it

became a pupa, having first attached itself to the sides of the cell by a few short silky threads. It had now contracted in length, become nearly oval, and assumed a yellowish tint, with a few short, loose, silky threads adhering to different parts of the surface. On the 11th of February we examined some more seeds, and found the larvæ within still alive and active, just as they had appeared in the fall. On the 7th of July further specimens were opened, and the inmates still found soft but motionless; these appeared to be in the pupa state, but the slight inspection then given was not sufficient to enable us to be positive. During the remaining part of July we looked many times into the bottles in which the grapes were enclosed, but did not discover anything till on the 9th of August, feeling sure that the time for the appearance of the insects must be fully come, if not already past, we resolved on a thorough search for them. As soon as the contents of the bottles had been emptied on a piece of white paper, we observed a number of small four-winged flies, from one-fifteenth to one-tenth of an inch long, among the dried-up grapes. These were all dead and stiff, though some were more brittle than others. From the observations made we should judge that they effected their escape from the middle to the end of July.

The following description of the insect, being somewhat technical, is given more for the benefit of the scientific reader than for the general public. We thus give due notice so that all who have no taste for scientific descriptions may make a clean jump over the next two paragraphs.

Isosoma vitis—Saunders—Female.—Head large, flattened in front, black, thickly punctured, and covered with many short whitish hairs; mandibles pale brown at base, tipped with black. Antennæ (scape and eight joints) nine jointed, black, thickly covered with whitish hairs, inserted in deep sockets; the scape pale brown, slender, nearly as long as the three following joints together; the second short; third to eighth inclusive, nearly equal in length; the terminal joint longer, tapering slightly towards the tip. Thorax black, punctured, and covered with whitish hairs. Legs—front pair pale brown, trochanters nearly black; second and third pairs, trochanters black, femora and tibia nearly black along the middle, pale brown at tips, tarsi pale brown. Abdomen long, black, straight and smooth, with a polished surface placed on a short pedicel; a little contracted at base, thickest on third joint, tapering gradually to fifth, and then suddenly to extremity; the basal joint very short, second and third each somewhat longer, fourth as long as the three preceding, fifth less than half as long as the fourth, sixth a little shorter, terminal joint rather longer.

The male differs from the female in having the antennæ longer and more thickly covered with hairs. The abdomen is short, thick and blunt, and placed on a moderately stout pedicel nearly its own length. The abdominal rings have about the same relative size as in the female, but the posterior edge of the third overhangs the fourth, the latter appearing as if partially drawn within the projecting edge of the third ring.

Length—Female 0.10, male 0.06 inch.

Having kept the grapes in bottles only occasionally opened for ventilation, in a dry room, they became hard, dry and shrivelled. In consequence of this many of the flies were unable to make their way out, the seed having become too hard for their jaws to eat through. On opening some of these the flies were found dead, with wings fully developed, and surrounded by small fragments of the interior coating of the seed, which they had gnawed off in their efforts to escape. Those which had found their way out had eaten a small, nearly round, irregular hole through seed and skin. In many similar cases, where the larvæ feed within a hard substance, they provide for the escape of the perfect insect by eating away the hard enclosure until it is reduced so thin as to appear almost transparent, when a very little effort is sufficient to remove the obstruction to the outward passage of the perfect insects. In this instance we have been unable to discover any evidence of such preparation, and believe that the whole work of escape is accomplished by the perfect fly.

Should it prove sufficiently troublesome to necessitate man's agency to keep it within proper bounds, we can advise nothing better as a remedy than carefully gathering and destroying the shrivelled fruit.

No. 11 —THE THRIPS (so called) (*Tettigonia vitis*, Harris). The accompanying figure represents, faithfully, the insect commonly known among vine-growers as "the Thrip." The figures are magnified, the small hair lines adjoining showing the natural size. The figure to the left shows the perfect insect, with its wings expanded. These so called "Thrips," which are widely distributed, and exceedingly numerous and destructive to the vine, do not belong to the family of true Thrips at all, and the fact of their being mis-named by the fruit-growers has occasioned, in times past, much confusion and uncertainty as to what was really meant when this term was used. The true "Thrips" is a smaller insect than this, and, as Mr. Walsh, of Rock Island, Ill., has proved; is an insect feeder, and hence a friend rather than an enemy to the vine-grower, while the vine-growers' Thrips, as figured above, is a species of



FIG. 50.

Tettigonia, the figure being that of *Tettigonia vitis*. This "*vitis*" is only one member of a family. Mr. J. Pettit, of Grimsby, has found six distinct species in his neighborhood, and we have noted four, while examining about a dozen specimens taken at random from a vine. They are all much alike in size and general appearance, the points of distinction being found in the varied markings of the wings. Besides *vitis*, we have *tricincta* and *vulnerata*, *comis*, and *obliqua*, and probably not less than two species undescribed. In *vitis* the colors are pale yellow and red.

Now for its history:—The "Thrips" is supposed to pass the winter in the perfect state, hibernating under decaying leaves or other rubbish. Those which survive appear early in spring, and deposit their eggs on the young leaves of the vine. The young progeny make their appearance during the month of June, when they are quite small, and while resembling the perfect insect in everything, excepting wings, of which they are destitute; they are in that condition and period of growth corresponding with the caterpillar or larva in other insects. As they increase in size they several times shed their skins, which are nearly white, and although exceedingly delicate and gossamer-like, remain for some time attached to the under side of the leaves. They live and feed together on the under surface, and are very quick in their movements, hopping almost as briskly as a flea. Their hind legs are constructed somewhat after the model of the grasshopper, elongated, and armed with rows of spines, by means of which they jump with great force. Mr. Walsh well remarks that "they have a peculiar habit of running sideways, like a crab, and when they see you looking at them upon one side of a leaf, they will often dodge round quickly to the other side, as a squirrel dodges round to the opposite side of the trunk of a tree, when he sees that he is noticed. Insects are more wide-awake than people generally suppose."

These little creatures are furnished with a sharp beak or proboscis, with which they puncture the skin of the vine, and through which they suck up the sap. Wherever they thrust their beaks and absorb the juices of the leaf, just there, on the upper surface, appears a dull yellowish or brownish spot. While they are yet young and small, the spots produced are also of small size, and scarcely attract attention, but as they increase in size their abundant labors become very manifest, even to the most careless observer, for the whole leaf assumes a sickly aspect, paled with yellowish spots, and as if scorched, drying up, and prematurely dropping from the vine. Sometimes the vines are thus so defoliated that the fruit fails to ripen for want of proper nourishment. Though small in size, their immense numbers make up for any lack in this way, so that they really are a formidable enemy, probably the most serious the vine-grower has to encounter.

As it enters the second stage of its existence, corresponding to the chrysalis state of moths and butterflies, it continues increasingly active. Diminutive wings now begin to appear, which gradually grow until fully matured, when the insect is in its perfect condition. This happens about August. The addition of wings increases its activity, and its power of spreading itself. It continues active and mischievous till late in the season, when it is supposed to seek shelter, and spend the winter in a state of torpidity, as already stated.

The Clinton, Delaware, and other thin-leaved varieties, suffer more from the attacks of these insects, than the thick, leathery-leaved sorts. Concord is almost exempt, but we have known the Isabella to be much damaged. The Thrips are widely distributed, but vary much in numbers from year to year. If abundant in a particular locality one season, we cannot be at all certain that they will be equally or more plentiful the following year. Their natural increase is so interfered with by various unfavorable climatic and other influences, that we cannot prognosticate in this matter with any degree of certainty. Mr. J. Pettit informs us that, three years ago, he saw many vines in the vineyard of Mr. W. W. Kitchen, of Grimsby, completely stripped of their leaves by this pest, but they do not appear to have occurred in such numbers since. Mr. W. H. Mills, of Hamilton, has found them very common and troublesome in his garden for years past, and the Rev. R. Barnett, of the same place, says they are the only determined enemy the grape has in his locality. This season they prevailed in some vineyards to such an extent that the injury done the leaves seriously affected the growth of the fruit; as far as his memory serves him, he has always had more or less *Thrips*.

Mr. James Dougall, of Windsor, states that the Thrips were formerly much more troublesome than they have been during the past season; this year there were very few. Mr. D. W. Beadle, of St. Catharines, bears similar testimony. He says, "the Thrips were very plenty in 1868, and injured the foliage of the Delaware and Clinton badly, the more downy-leaved grapes less, the Concord not at all. Since then they have not been sufficiently abundant to do any harm." Mr. A. B. Bennett, of Brantford, remarks, "the Thrips has made its first appearance with me this fall, but not to do any perceptible damage. I am fearful for the future." Mr. Charles Arnold, of Paris, has suffered much from Thrips in years past, and still finds them very troublesome. Two years ago, while looking over the extensive vineyards of the Vine Growers' Association, at Cooksville, we observed their Clinton vines swarming with Thrips, the foliage appearing half bleached and scorched. We believe they have not suffered so much from them since. These insects do not appear to be known about Quebec. In our own locality they seem to have permanently established themselves, and annoy and perplex us every season.

Various remedies have been suggested, but no universal panacea has yet been devised. Syringing with strong tobacco water or soap suds, dusting with sulphur and lime, or lime alone, hellebore, Cayenne pepper, or fumigating with tobacco under a moveable tent, all have their advocates. It is also said that carrying a lighted torch through the vineyard at night, has been found very efficient in destroying them, they fly to the light and are burnt. This remedy would require repeating several times at short intervals. Rev. R. Burnett, in a recent letter, says:—"I know of several parties who have practised the torch light for the destruction of the Thrips, accompanied with less or more success. Mr. Haskins, of the City Water Works, one of the most intelligent and best informed of our grape culturists, prefers the constant stirring of the earth in the immediate vicinity of the vines in spring and fall." This latter remedy probably operates by disturbing the perfect insects about the commencement or termination of their winter's sleep, and exposing them to the killing influence of frost.

They are not confined to the vine, but affect also the Virginia creeper.

No. 12.—THE GRAPE LEAF GALL LOUSE (*Pemphigus vitifoliae*, Fitch). The gall on the leaf of which we are now about to treat, is the work of a small orange-colored louse, which has been named by Dr. Fitch, State Entomologist of New York, *Pemphigus vitifoliae*. Subsequent observations have shown that it does not belong to the family of *Pemphigus*, and some difference of opinion exists among leading Entomologists as to what family it should be placed in, but wherever it may be eventually located the specific name *vitifoliae* will hold good.

Figure 51 represents a leaf covered with the galls above alluded to. They affect only the Clinton, and other derivatives of the Wild Frost Grape. They appear as green excrescences of various sizes and shapes, but generally rounded, and not much larger than a pea. In the second volume of the *American Entomologist*, p. 61, is an excellent account of their origin and growth from the pen of Mr. Riley, which we shall quote:—"In each freshly formed gall you will find from one to four orange colored mother lice, a number of shining oval whitish eggs, of very minute size, and often a number of six-legged larvæ, scarcely bigger than the eggs, and of the same whitish color. Almost as soon as the larvæ

hatch, they stray off through the partly open mouth of the gall on the upper surface of the leaf, and found new galls either on the same or on a younger leaf. After a time, and when their stock of eggs is exhausted, the mother lice die, and the galls inhabited by them gape widely open at their mouths, and become gradually flattened and obliterated. Thus upon a grape cane the galls upon the oldest leaves will be empty, while those on the young thrifty ones will be swarming with inhabitants, and as fresh leaves put out these are successively 'occupied and possessed' by the 'enemy.' The gall is formed, as with all those constructed by plant lice, by bark lice, or by mites, by one or more young larvæ stationing themselves on the upper surface of the leaf, and irritating it with their pointed beaks until it bulges out in an unnatural hollow, inside which the larvæ remain. Finally, as the larvæ grow to maturity the hollow becomes a fleshy green sack, the mouth of which is almost closed up. The mother lice then lay eggs, and the same old cycle of phenomena is repeated again and again till winter sets in.



FIG. 51.—Color—Green.

We do not apprehend that this is likely to become here a very formidable foe to vine-culture, but its aspect is unsightly, and it may easily be checked on its first appearance by picking off the infected leaves and burning them. Mr. D. W. Beadle, of St. Catharines, informs us that he has seen it occasionally on his vines, but found no difficulty in staying its progress by the method above referred to. It has also been seen occasionally in the vineyards at Cooksville, but it has never spread much; possibly this may be due in part to the fact that it is preyed upon by a number of rapacious insects, such as the larvæ of *Scymnus*, a small dull colored lady-bird; larvæ of lace-wing fly, and those also of several species of two winged flies.

Since the above was in type a valuable paper on this insect has appeared in the "American Entomologist," vol. 2, No. 12, written by the editor, C. V. Riley, Esq., containing many new and interesting facts, some of which are so very important that we feel it a duty we owe to vine-growers to give them as much publicity as possible. The following we have condensed from Mr. Riley's paper:—

For many years past a very serious disease has affected the roots of the vines grown in many parts of France, and which was known under the name of *pourridie* or rotting. So grievous and alarming had this disease finally become that the French Minister of Agriculture and Commerce offered a reward of 20,000 francs to any one who should discover an efficacious and practical remedy, and appointed a special commission, including some of the most eminent men in natural science, to test the proposed remedies and make the award.

The disease appears in the form of little cankerous spots which cut off the supply of nourishment and cause the roots to rot. These were ascertained by M. M. Planchon, one of the members of the commission, and M. J. Lichtenstein, of Montpellier, to be caused by a small louse called by M. Planchon, *Phylloxera vastatrix*, which bears a close resemblance to the insect which forms our leaf gall. Besides this, a leaf gall occurs there identical in appearance with ours, and after much observation it was discovered that the root-inhabiting and gall-inhabiting insects were identical, and finally it was concluded by M. J. Lichtenstein that their European species was in all respects the same as our American one, and had been imported from this country.

The expression of this view by so eminent a savant added much interest to the study of the American Gall Louse, and induced Mr. Riley to devote much time to working out the facts connected with its history, so as to definitely decide this question of identity. He opened a correspondence with M. Lichtenstein and M. Signoret, of Paris, on this subject and forwarded specimens of the American insect in its various stages to be compared with theirs. The war has interfered sadly with the progress of all departments of science in

France, but from a letter received from M. Signoret, despatched just before the investment of Paris, in which place he is now shut in, he expresses himself as convinced of the identity of the two species.

In the meantime Mr. Riley has discovered that our gall insect also attacks the roots of vines here in the same manner as does the insect in Europe, and Dr. Shimer, another careful and painstaking entomologist in the U. S., has shown that the winged females have the same characteristic markings as the European species, hence there is little doubt as to the correctness of the conclusions arrived at regarding their common origin.

Since it has been decided by eminent French entomologists, who have made a special study of plant-lice, that the insect in Europe belongs to the genus *Phylloxera*, our species will hereafter be known as *Phylloxera vitifolia*.

In continuation of that part of the history of the species already given, Mr. Riley says:—"In August the insects generally become so prodigiously multiplied that they often settle on the tendrils, leaf-stalks and tender branches, where they form excrescences and gall-like growths, differing only from those on the leaves in such manner as one would naturally expect from the difference in the tissues. After the vine has finished its growth the young lice, finding no more succulent and suitable leaves, begin to wander and to seek the roots, so that by the end of September the galls are deserted, and those remaining on the vines generally become mildewy, and finally turn brown and dry up. Upon the roots the lice attach themselves singly or in little groups, and cause by their punctures little swellings or knots which eventually become rotten. Where vines have been badly affected with the gall, it is difficult to find a perfectly healthy fibrous root. Strange enough these lice not only change their residence as winter approaches, from the leaf above ground to the root below ground, but Proteus-like they change their appearance also, and after shedding their skins present themselves covered with small tubercles."

These tubercled insects pass the winter on the root, and probably produce in spring the winged males and females which pair and deposit eggs on the grape leaves, which give birth to the wingless females who are the founders of the gall producing colonies.

From these facts it is evident that the insect can be carried from one place to another on the roots, and doubtless it was by some such mode that it was introduced into France from this country. Its natural home here is on the wild Frost Grape, from which it must have spread to the cultivated varieties, and since this wild grape is found over a wide range of our country, the insect in all probability is equally widespread. The knowledge of the fact of its wintering on the roots would point to the necessity in extreme cases of rooting up and burning such vines as may become very much diseased, so as to check the increase of this pest; close attention should also be paid to plucking and destroying the gall infested leaves as soon as they appear in spring. It may also be well in certain localities to avoid planting any varieties of the Frost Grape, but we scarcely think that such a precautionary measure will need to be adopted in Canada. It would appear from various information gathered, that the insect is much more likely to be troublesome in warmer latitudes than in cold ones, the length of the season being favorable to their greater increase, and the milder winters less destructive to them. Still it will be well for all our grape-growers to keep a sharp look out for this enemy and meet it with a determined effort at its destruction wherever it may appear.

Although hitherto almost entirely confined in its attacks to the Frost Grape and its progeny, a few have of late been found occasionally on the Delaware, Iona and Concord, and since it has so readily taken to the European varieties of the *Vitis vinifera*, it may also attack hybrids of this species grown in our own country.

This gall louse has proved very injurious to the Clinton vine in many parts of Missouri, occasionally defoliating and almost destroying large portions of some vineyards.

The liberal prize offered by the French government has not, we believe, been awarded, for no specific seems yet to have been discovered. The location of the insects on the roots would naturally render it extremely difficult to apply any remedy—Carbolic acid and water, and sulphuret of lime and water, have both been recommended, but neither of them appears to have been tried on a sufficiently extensive scale to prove their efficacy in this case.

No. 13.—THE TREE CRICKET (*Ecanthus niveus*, Harris). This insect, although de-

structive to the vine, is not confined to it in its operations; for it is equally injurious to the raspberry and blackberry, and sometimes attacks the plum, cherry and peach. Fig. 51



FIG. 51.

represents the male and Fig. 52 the female. Their color is of a delicate green, and they are exceedingly lively and musical, keeping up, when numerous, a perpetual sharp, chirruping noise during the warmer parts of the day. The tree cricket is accused, on good authority, of severing grapes from the bunches, and sometimes even cutting off an entire bunch. Mr. C. V. Riley, from whose valuable observations we have drawn so largely, says that he has caught them at it; but probably such malicious acts are rare, for, though the insect is common enough with us, we have never observed any such results from its presence. The heaviest charge brought against it is for the partial destruction of the canes, and this arises from the carrying out of its own instinctive care in providing for the safety of its progeny. The female, during the later weeks in autumn,

being fully charged with fertilized eggs, proceeds to prepare a place for their reception; settling itself comfortably down on a grape, raspberry or other cane, and elevating the posterior parts of its body, it thrusts its long ovipositor, with which it is furnished, straight into the stem, about half way through its thickness.

Into the orifice thus formed it forces a long yellow egg, and then proceeds to deposit another alongside, and so on, until from five to fifteen eggs have been placed in a row. In this manner, the stem on which it operates is very much weakened and is liable to break off on slight occasion; or where this does not occur, the branch often dies beyond the punctured part. Each female will deposit from twelve to sixteen eggs, which remain thus during winter safely lodged.



FIG. 52.

Color—Pale green.

Early in spring the eggs begin to swell, and about midsummer, or a little before this, the young insects appear. An Ohio correspondent of the *Practical Entomologist*, vol. 2, p. 94, says that he kept portions of infested cane in a drawer, from which the young insects appeared on the 20th of May. Possibly the additional warmth and protection thus given to the canes may have hastened the hatching of the young, for we have found the unchanged eggs in the canes, in the open air, later than this. When first hatched, they feed on plant lice, and probably continue to do so until nearly full grown. We have seen the matured insect feeding occasionally on ripe plums. Mr. Riley, in the *American Entomologist*, vol. 1, p. 247, says:—"We hatched a number of them this spring; they fed entirely on plant lice at first, but when these were denied them, they fell to devouring one another, until the strongest individual remained the conqueror."

In consequence of their destruction of plant lice, it has been urged by some that they should be regarded rather as friends than enemies; but we think that the injury they do far more than counterbalances any good that can be placed to their credit, and we would advise their destruction. First kill as many of the perfect insects as possible, which may best be done by jarring the canes, when they drop to the ground, and stamping their lives out with the foot before they have time to hop or fly away. The second, and probably the easiest method, is to cut away, late in the fall or early in spring, all those parts of the canes containing eggs, and burn them. Their regular rows of pin-hole punctures can be readily seen.

No. 14.—THE HONEY BEE (*Apis mellifica*, Linn). Before leaving this subject, we must advert to a charge made against that very useful insect, the honey bee, of injury, which, we trust, will not be found very widespread. A correspondent in the *American Entomologist*, vol. 1, writing from Richmond, Indiana, says that he has found the honey bee very destructive to his grapes. They commenced about the last of August, on the Concords, which, to save from complete destruction, he was obliged to gather before fully ripe. The bees puncture the skin of the grape and extract the sugar, when the fruit immediately shrinks up and soon rots, unless used at once. The vines which suffered most were Diana, Delaware, Isabella and Rogers' Hybrids. Of Diana, he lost fully a bushel of grapes, and of Delaware, about as many.

Mr. James Dougall, of Windsor, in a recent letter, says that the greater part of his

grapes were punctured, and the juice sucked out. He has not been able to detect anything but flies at them, the same as often attack the cherries. The worst flies, he states, are several varieties of the blue bottle, and "a large flatter fly, with a spotted greyish body and wings." Might not this have been occasioned first by the honey bee puncturing the grapes, and the flies subsequently gathering to feast on the juices which would escape through the punctured skin? Mr. Dougall says that the grapes which ripened later were scarcely touched.

In concluding this section of our report, we would express our thanks to the gentlemen who have kindly replied to our many queries, and thus sent us much valuable information on the habits and geographical distribution of the various species.

INSECTS AFFECTING THE PLUM.

BY E. B. REED, LONDON, ONT.

- | | | | | | | | | | | |
|-----------------------------------|---|---|---|---|-----------------------------------|---|---|---|---|---------|
| 1. The Plum Curculio | - | - | - | - | (<i>Conotrachelus nenuphar</i>) | - | - | - | - | Beetle. |
| 2. The Grey Dagger | - | - | - | - | (<i>Acronycta Psi</i>) | - | - | - | - | Moth. |
| 3. The Oblique Banded Leaf Roller | - | | | | (<i>Lozotenia Rosaceana</i>) | - | - | - | - | Moth. |
| 4. The Eye-Spotted Bud Moth | - | - | | | (<i>Grapholitha oculana</i>) | - | - | - | - | Moth. |

1ST. THE PLUM CURCULIO (*Conotrachelus nenuphar*, Herbst).

COLEOPTERA, CURCULIONIDÆ.

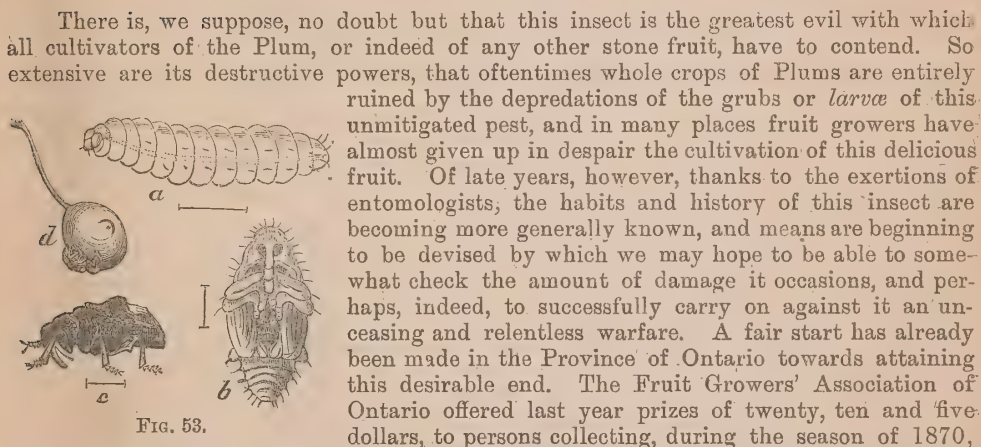


FIG. 53.

There is, we suppose, no doubt but that this insect is the greatest evil with which all cultivators of the Plum, or indeed of any other stone fruit, have to contend. So extensive are its destructive powers, that oftentimes whole crops of Plums are entirely ruined by the depredations of the grubs or *larvæ* of this unmitigated pest, and in many places fruit growers have almost given up in despair the cultivation of this delicious fruit. Of late years, however, thanks to the exertions of entomologists, the habits and history of this insect are becoming more generally known, and means are beginning to be devised by which we may hope to be able to somewhat check the amount of damage it occasions, and perhaps, indeed, to successfully carry on against it an unceasing and relentless warfare. A fair start has already been made in the Province of Ontario towards attaining this desirable end. The Fruit Growers' Association of Ontario offered last year prizes of twenty, ten and five dollars, to persons collecting, during the season of 1870, two thousand, one thousand, and five hundred, respectively, of the Plum curculio. Fourteen persons competed for these prizes, and their joint collections contained the large number of fourteen thousand five hundred and fifty-three specimens of the genuine Plum curculio. All the competitors in detailing their experiences, appear to be well satisfied with the crop of Plums that rewarded their individual exertions, and anxious for other plum growers to follow their example; and there can be no reasonable doubt that similar efforts on the part of others throughout the country, will tend eventually to thoroughly check the operations of the enemy. For the interesting details of the efforts and work of the above competitors, we would call the attention of our readers to the admirable report on the subject, made by W. Saunders, Esq., of London, Ont., to the Fruit Growers' Association. The Plum curculio is a member of an enormous group of insects known as weevils, or snout beetles. The chief characteristic is the long snout into which the front of the head is produced, the mouth being at the end of the snout or beak. This snout is

of course immovable, except along with the head, of which it is in fact part and parcel. The antennæ are elbowed, *i.e.*, bent at right angles, and are set on the sides of the beak. The plum curculio, or "Little Turk," as our American cousins have named it, in allusion to the crescent-shaped wounds it inflicts on the fruit, is a little rough grey or blackish beetle, about one-fifth of an inch in length; it may easily be distinguished by its having on the middle of each wing-case, a black shining hump, immediately behind which is a broad band of yellowish white; the snout is rather short, and when the insect is alarmed, it is drawn up close to the under side of its body, and in this attitude, with its legs also drawn up in a similar manner, it bears a strong resemblance to a dried bud, or piece of dirt, or bark, and is very apt to deceive the uninitiated, more especially as it will remain for a long time motionless and seemingly devoid of life, though if the observer has but the requisite patience, and the day be sufficiently warm, he will see the apparently shapeless little lump gradually put forth a leg here and a feeler there, and finally being convinced of security, expand its wings and fly away in search of other objects of attack. Dr. Harris records having frequently caught them flying in the middle of the day. The curculio generally attacks the plum as soon as the fruit is fairly set, although while the tree is yet in blossom they may often be discovered by the jarring process. C. V. Riley, the State Entomologist of Missouri, thus describes the manner of laying the egg:—"The process occupies about five minutes. Having taken a strong hold on the fruit (see Fig. 53 *d*), the female makes a minute cut with the jaws, which are at the end of her snout, just through the skin of the fruit, and then runs the snout under the skin to the depth of one-sixteenth of an inch, and moves it back and forth, until the cavity is large enough to receive the egg it is to retain; she next changes her position, and drops an egg into the mouth of the cut, then, veering round again, she pushes it by means of her snout to the end of the passage, and afterwards cuts the crescent in front of the hole, so as to undermine the egg and leave it in a sort of flap; her object apparently being to deaden this flap so as to prevent the growing fruit from crushing the egg, though Dr. Hull informs me that he has repeatedly removed the insect as soon as the egg was deposited, and before the flap was made, and the egg hatched and the young penetrated the fruit in every instance."

The egg, being deposited, is in a few days hatched into a small, white, footless grub, which increases rapidly in size, eating its way almost to the centre of the fruit. After the lapse of several weeks, and before the grub is fully grown, the plum drops to the ground, its natural growth being stopped by the workings of the grub, which in a short time, having reached its maturity, eats its way to the surface and penetrating the earth a little distance, makes a small cavity for itself, and there changes into a chrysalis or pupa. In this inactive state, it generally remains for some three or four weeks, when it finally appears as the perfect beetle, and continues in that state until the succeeding spring, when it proceeds to attack the plum after the manner of its forefathers. In some cases, however, owing perhaps to various causes of place and temperature, some few individuals may pass the entire winter in the pupa state, and not complete their transformation until the following spring, but the better opinion seems now to be, that such is not the normal custom of the insect. As many of our readers may be unacquainted with the appearance of the different stages of this insect, we have prepared at Fig. 53, correct and magnified portraits of the full grown *larva* (*a*), of the chrysalis, or *pupa* (*b*), into which the larva is transformed, of the perfect curculio (*c*) and of the crescent-shaped mark it causes (*d*). Dr. James Tilton, of Wilmington, Delaware, was one of the earliest observers of the plum weevil. In an article published by him in 1803, he states that this insect attacks not only nectarines, plums, apricots and cherries, but also peaches, apples, pears and quinces, and later writers have fully confirmed this statement. In 1831, Mr. Thomas Say, the chief authority on American entomology, in a note on the plum weevil, stated, "that it depredates on the plum and peach, and other stone fruit," and that his "kinsman, the late excellent William Bartram, informed him it also destroys the English walnut in this country." Dr. Harris, the late State Entomologist of Massachusetts, ascertained that the cherry worm, so called, produced at maturity the same curculio as that of the plum; though, unlike the latter, it rarely causes the stung cherry to drop prematurely to the ground; and the late Dr. Joel Burnett, the author of several articles on the plum weevil,

procured, in 1839, some specimens of the insect in the chrysalis state, which were raised from the small grubs in apples. Much as has been written on the subject of the plum curculio, there are several points in its history on which observers are unable to agree, such as the length of time it occupies in its various transformations, the manner and place in which it hibernates, or passes the winter, and whether it is single or double brooded in each year.

Dr. Harris writes "that the average time passed by the insect in the ground during the summer has appeared to me to be about three weeks; but the transformation may be accelerated or retarded by temperature and situation. It has also been my impression that the late broods remained in the ground all winter, and that from them are produced the beetles which sting the fruit in the following spring. Dr. Burnett's observations coincide with this opinion. According to him the insect "undergoes transformation in about fifteen or twenty days, in the month of June or fore part of July; but all the larvæ (as far as he had observed) that go into the earth as late as the 20th July, do not ascend that season, but remain there in the pupa stage until next spring." Dr. Tilton, in his account of the curculio, stated that "it remains in the earth in the form of a grub, ready to be metamorphosed into a beetle as the spring advances." According to M. H. Simpson, Esq., of Saxonville, the larvæ, or grubs, "go through their chrysalis state in three weeks after going into the ground, and remain in a torpid state through the season, unless the ground is disturbed." Dr. E. Sanborn, of Andover, has come to entirely different conclusions, from a series of experiments made upon these insects. It is his opinion that they do not remain in the ground during the winter, either in the grub or in the beetle state, but that under all conditions of place and temperature, in "about six weeks" after they have entered the earth, they "return to the surface perfectly finished, winged and equipped for destruction." Dr. Trimble, who devoted a large portion of a very extensive and elaborately got up volume to the history of this pest, decided that it passes the winter above the ground in the perfect beetle state, and that it is single brooded. Mr. B. D. Walsh, the late talented State Entomologist of Illinois, in an able article in the *Practical Entomologist*, gives very strong grounds for believing that the curculio is only single brooded, although he afterwards, on what seems to us very insufficient evidence, decided that it is double brooded. Mr. Riley states that Dr. E. S. Hull, of Alton, Illinois, who has had a vast personal experience with this insect, concludes that they are single brooded and pass the winter for the most part in the preparatory state underground.

Dr. Harris records having found these beetles as early as the 30th March—an almost conclusive proof that they must have wintered in the perfect state above ground. Dr. Trimble observed them hibernating under the shingles of a roof, in the chinks of a stone wall, and under the bark of an apple tree during the fall and early spring.

The number of eggs that the female curculio deposits has been made the subject of minute investigation. Dr. Harris seemed to think that only one egg was deposited in a single fruit, but Mr. Riley states that four or five larvæ may often be found in single specimens of the larger fruits. Dr. Trimble, who dissected many of these insects, states that the greatest number of eggs ever found by him in a single curculio was twenty-five, while other writers appear to think that the actual number of eggs laid is very much larger.

Having now reviewed at some length the natural history of the "Little Turk," we will avail ourselves of the conclusions drawn by Mr. Riley, founded on his own observations as well as on those of others. In his first annual report, in an able article on this subject, he rehearses the following articles of belief:

1. "That Plum Curculios are more numerous in timbered regions than on the prairie.
2. That they *can* and *do* fly during the heat of the day, and that cotton bandages round the trunk, and all like contrivances to prevent their ascending the trees, are worse than useless, and a result only of ignorance of their economy.
3. That they prefer smooth skinned to rough skinned fruit.
4. That they deposit and mature alike in nectarines, plums, apricots, cherries and peaches; in black knot on plum trees and in some kinds of apples, pears and quinces,

and, according to Dr. Hull, they deposit, but do not mature, in strawberries, gooseberries, grapes, and in the vigorous shoots of the peach tree.

5. That it is their normal habit to transform under ground, though some few undergo their transformations in the fruit.

6. That all other fruits but the cherry, when containing larvæ, usually fall to the ground.

7. That the *greater portion* of them pass the winter in the perfect beetle state, under the old bark of both forest and fruit trees, under shingles, logs, and in rubbish of all kinds, and especially in the underbrush of the woods.

8. That they are always more numerous in the early part of the season on the outside of those orchards that are surrounded with timber, and that they frequently shelter in apple trees and other trees before the stone fruit forms.

9. That a certain portion of them also pass the winter underground, both in the larva and pupa states, at a depth frequently of from two to three feet.

10. That those which hibernate as beetles leave their winter quarters and commence throughout Central Missouri (Mr. Riley's State) to attack the fruit in the early part of May.

11. That those which hibernate underground continue to develop, and issue from the earth during the whole month of May.

12. That both males and females puncture the fruit for food by gouging hemispherical holes, but that the female alone makes the well-known crescent shaped mark (see Fig. 53 *d*), as a nidus for her egg.

13. That the egg is oval, of a pearly white color, large enough to be seen with the naked eye, requires a temperature of at least 70° Fahr. to hatch it, and may be crushed with the finger nail without injuring the fruit.

14. That the stock of eggs of the female consists of from fifty to one hundred, and that she deposits from five to ten a day, her activity varying with the temperature.

15. That the last of those curculios which hibernated in the imperfect state underground have not finished depositing till the end of June and beginning of July, or about the time that the new brood developed from the first laid eggs of the season are beginning to issue from the ground, and that we thus have them in the month of June in every conceivable state of existence, from the egg to the perfect insect.

16. That the period of egg depositing extends over two months.

17. That all eggs deposited before the first of July generally develop and produce curculios the same season, which issue from the ground during July, August, and September, and hibernate in the perfect state.

18. That most of those eggs which are deposited after the first of July either fail to hatch or the young larvæ die soon after hatching, owing, perhaps, to the more ripe and juicy state of the fruit being less congenial to them, and that what few do mature which hatch after this date undergo their transformation more slowly than the rest, and pass the winter in the ground.

19. That the perfect curculio, while in the ground, is soft and of a uniform red color, and that it remains in this state an indefinite period, dependent on the weather, usually preferring to issue after a warm rain.

20. That in a stiff clay soil a severe drought will kill many of them while in this last-named condition, and that larvæ contained in stone fruits that fall upon naked ploughed ground where the sun can strike them generally die."

Bearing in mind that Mr. Riley is writing of his own State of Missouri, which is about a fortnight earlier in its spring than Western Ontario, our readers must alter somewhat his dates, so as to make them applicable to their several localities.

Let us now consider what means we can best adopt for carrying on a successful and vigorous campaign against the attacks of this destructive insect:

And first let us see what allies Dame Nature will afford us.

Foremost in the ranks are two or three species of carnivorous ground beetles belonging to the order of Carabidæ—of these, one *Harpalus Pennsylvanicus*, or the Pennsylvanian ground beetle, represented at Fig. 54, is by far the most common, and may be met with at all times and seasons. It is stated by Mr. Walsh that its larva is a most merciless devourer of the grub of the curculio, attacking it even underground. Below will be found a correct sketch of the larva, of the natural size (Fig. 55 A). B represents the under side of the head, showing, at c, the upper jaw (mandible,) at g, the lower jaw (maxil,) with its four-jointed feelers (palpi,) at f, the lower lip (labium,) with its two-jointed feelers (palpi,) and at e, the (antenna). The larvæ of all the species of this order of beetles are carnivorous and furnished with a most formidable pair of jaws. Mr. E. Leeming, of Cobden, Illinois, thus describes their mode of attack:—"Four larvæ were taken out of peaches that had contained the larva of the curculio, the other two were lurking under a peach. I had the satisfaction of seeing one of them fasten his jaws upon the larva of the "Little Turk"; the larva squirmed dreadfully, but in vain, for his remorseless foe held him tight, and he soon gave up the ghost."



Colors—Dull black and brown.

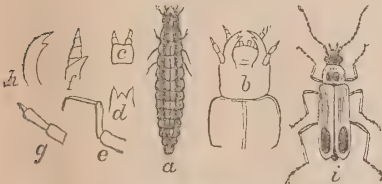
There are many species of these ground beetles. We would call the attention of our readers to the one represented at Fig. 54. It will give a good general idea of the shape of these insects, although there are several species much larger than our friend *H. Pennsylvanicus*. Many of them fly into our houses at night, attracted by the lights. Any beetles of this or a similar shape, with bright metallic colors or spots, that may be found under stones or chips, or running among grass or the roots of trees may be generally set down as members of this family of Carabidæ or ground beetles; they should be carefully protected, for, with one or two exceptions, the whole family are most beneficial to the fruit-grower, both in their larval and perfect state.

Fig. 55.



Colors—Brown and whitish.

Fig. 56.



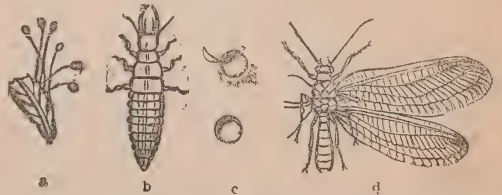
Colors—*a*, rich reddish brown; *i*, yellow marked with black.

The yellow beetle, with two black blotches on its wings, represented at Fig. 56, belongs to a group of soft-shelled beetles (*Telephorus* family), common everywhere in Ontario. This species is named *Chauliognathus Pennsylvanicus*, or the Pennsylvanian soldier beetle, and may be found on the flowers of the golden rod. According to Mr. Riley, its larva (Fig. 56 *a*) is one of the most effectual destroyers of the curculio, while the latter is yet above ground in the larva state; it attacks the grub within the fruit while it is yet on the tree, and also enters the

fruit lying on the ground for the same purpose.

There is also a species of lace-wing fly (*Chrysopa*), which is one of our natural allies against the curculio, attacking the larva in the same way as the last described insect. We give a representation of the larva (Fig. 57 *b*), with its formidable mandibles; its curious eggs *a*, laid by the female fly, and attached by long, delicate filaments to a leaf; its wonderfully small cocoon with its smoothly cut lid *c*, and at *d* the perfect insect, which is common throughout Ontario, and may easily be recognized by its pale green slender body, its finely-netted wings, its brilliant golden eyes, and especially by the very disagreeable odor it emits.

Fig. 57.



The larvæ of all the lace-wing flies are carnivorous, and they attack a great variety of noxious insects. Mr. Leeming writes Mr. Walsh that he had found over one hundred of these lace-wing larvæ in the very act of devouring the curculio larvæ. Mr. Riley points out a curious fact hitherto unnoticed in the history of this insect, which is that the insect issues from the cocoon in an active sub-imago state, from which, after a few hours, the winged-fly emerges, leaving behind it a fine silvery-white transparent skin.

The artificial remedies that have been devised against the attacks of the curculio are numerous. Many are apparently very ingenious in theory, but utterly useless in practice; others, again, are preposterous in their very conception, and appear only to be devised to delude the veriest tyros and greenhorns—we do not propose to weary our readers with discussing them. What we want to bring before their notice are those remedies which experience has shown to be really successful, and also really practicable. These remedies may be divided into two classes—1st, those directed against the insect in its egg and larval state, and 2nd, those directed against the full-grown, matured beetle. For the first class, the most obvious and practical remedy is to destroy the fruit as fast as it falls from the tree; the fruit in this stage contains, as we have seen, the growing larva, which is soon to eat its way out and descend into the earth; it is, therefore most important to destroy the fruit as speedily as possible after its fall, and before the escape of the insect. Good, systematic hand-picking will be found to be the most certain way of destroying the larva in this stage; the fruit should be burnt or given to the pigs. Many people, indeed, especially in the Western States, turn their hogs into the plum orchard and use them for this purpose. Dr. Alton, of Illinois, who is, according to Mr. Walsh, one of the most successful plum-growers in the west, has tried this plan with success for some years; sheep and cattle have been also tried, but the objection to them is that they are very apt to bark, browse, and break down the trees. Poultry may be used with very good effect. Mr. Dougall, of Windsor, Ont., the well-known fruit-grower, has for some years kept numbers of poultry in his orchard, and he speaks most favorably of their services, to which he attributes the general success of his plum crops. Air-slacked lime is recommended by Mr. Bliss, the Secretary of the Warsaw Horticultural Society. He writes as follows:—"During the season of 1856, Mr. J. B. Matthews, now of Marietta, O., had six or eight Chickasaw plum trees growing in a cluster in his garden at Warsaw. On one-third of these he began throwing air-slacked lime as soon as the fruit set, and continued it after every rain and sometimes after a heavy dew, showering the trees until they were white with the fine dust. On one or two trees he used none at all; and on the remainder he commenced using the lime after the curculio had attacked the fruit. The lime dust was applied as often as once a week. Result—not one plum on those trees on which he did not use lime; a full crop of good fruit on those on which he commenced using lime early; and on those on which the curculios had begun their attack before he began to apply the lime, he drove them entirely away and saved a portion of the crop. I followed the same plan and saved so many plums as to break down my trees, as I was absent from home and did not have a chance to thin out the fruit, though I had the lime applied faithfully while I was away." In the report to the Ontario Fruit Growers' Association, made by Mr. W. Saunders, of London, Ont., in 1868, that gentleman makes mention of a friend who had tried lime for several years, and had had regular crops. He also states that he had received similar evidence from various other quarters, and that his own experiments with the lime were tolerably successful. It may therefore be recommended for trial, especially in moist seasons.

Another plan that has been tried, and apparently with some success, is to pave or cement the ground underneath the trees, so that when the fruit falls the insect may be unable to penetrate the earth and may be exposed to the rays of the sun, and, where poultry are kept, may be more easily espied and captured by them. Mr. Charles Arnold, of Paris, Ont., makes the soil quite smooth around the roots of the trees and whitewashes it with a thick coating of lime, which very soon forms a hard crust; this method he considers a very efficient one against the curculio in the larval stage of its existence. It is possible to remove the egg of the curculio from the plum and thereby save the fruit. The nail of the finger will do in default of a better instrument, although it leaves an unseemly scar. The egg should be removed as soon as possible after its deposit, as all attempts to save the fruit after the larva is hatched will be useless. This process is necessarily a very tedious one, and only to be resorted to in cases where young trees are

fruiting for the first time, and it is desired to save the fruit for tasting when all has been injured by the curculio. Dr. Trimble writes :—"The best instrument I have found for this delicate operation is a common quill toothpick, slightly rounded at the point and pared to a cutting edge. This must be insinuated under the concave side of the crescent shaped mark, so as to turn over the triangular portion of skin lying between the horns of the crescent and the end of the tube where the egg is deposited. The egg—a white round speck—will sometimes be exposed, and a very sharp eye will detect it without the assistance of a glass; but generally it will be so coated with a covering of the pulp of the fruit as to be invisible. Take off this speck of skin, egg and all. If properly done the fruit will come to maturity showing scarcely a blemish."

We now come to our second class of remedies, those which are directed against the beetle in its perfect state. The most satisfactory plan is to jar the trees regularly two or three times a day during the season, and to collect and destroy the curculios as they fall to the ground. Mere shaking the tree will do but little good; it must be a sharp sudden jar. The trouble of course is to discover the curculios after they drop. The old plan used to be to place white sheets under the trees and to pick up with the hand the insects as they fall, and destroy them at once. Dr. Trimble's method was to nail a stretcher of wood along one side of a large square sheet, and two shorter stretchers, each to one-half of the opposite edge of the sheet, which is slit from between the two short stretchers to its centre, to receive the trunk of the tree. In this way the sheet is more easily spread out, and the wind is not able to rough it up. The sheet should be emptied for every tree, as in the early part of the season many buds and blossoms will fall, and these should be carefully examined, as our insect foe, as we have before explained, bears a strong resemblance to a dried bud or piece of dirt. The sheet is easily carried by holding all three stretchers in one hand, letting the folds of the sheet hang down. The tree being reached, drop the long stretcher at the requisite distance, and pass one of the short ones round each side, until the centre of the slit fits up close round the trunk, then jar the tree, and then pick up and crush, and so on from tree to tree, repeating the process over the whole orchard as long as you find curculios. For striking the tree a good sized mallet is the handiest. If the trees are middle sized, it is a very good plan to saw off a limb of two or three inches in diameter, so as to leave a stump for striking the mallet upon. Where this cannot be conveniently done, or where the trees are small, it will be necessary to pad the mallet to prevent the bark being injured. In the case of older trees which have lost their elasticity and cannot always be jarred enough with the mallet to cause the curculio to let go its hold, Dr. Trimble recommends that a common mop stick, properly padded, be applied successively to the leading limbs one after another. These methods of jarring will be found perhaps the easiest and most practicable for those persons who have only a few trees or small orchards to manage. But for extensive fruit growers, who cultivate the plum on a large scale, Dr. Hull's "curculio catcher" will be found effectual in saving both time and money, although in order to run the machine successfully three things are necessary.

1st. That the land be decently clean and not overgrown with rank weeds.

2nd. That the orchard be sufficiently large to pay the interest on the prime cost of the machine (about \$30).

3rd. That the trees have a clean trunk of some three or four feet.

We give below a description of it in Dr. Hull's own words, as communicated to the *American Entomologist* :—"To make a curculio catcher, we first obtain a light wheel not to exceed three feet in diameter, the axle-tree of which should be about ten inches long. We next construct a pair of handles similar to those of a wheel-barrow, but much more depressed at the point designed to receive the bearings of the axle-tree, and extending forward of the wheel just far enough to admit a cross-beam to connect the handles at this point; $1\frac{1}{2}$ inches in the rear of the wheel a second cross-beam is framed into the handles, and eighteen to twenty-four inches further back, a third. The two last named cross-beams have framed to their undersides a fourth piece, centrally, between the handles, and pointing in the direction of the wheel. To the handles and to the three last named pieces, the arms or ribs to support the canvas are to be fastened. To the front part of the beam connecting the handles in front of the wheel the ram is attached. This should be covered with leather stuffed with furniture moss, a dozen or more thicknesses of old

hat leather or other substance, being careful to use no more than necessary to protect the tree from bruising. Ascertain the elevation the handles should have in driving and support them in that position. We now put in place the stretchers or arms, six for each side, which are to receive and support the canvas. We put the front arms in position. These extend back to near the centre of the wheel on each side, and in front of the wheel (for large machines), say six feet, are far enough apart to receive the largest tree between them on which it is intended to operate. The remaining arms are supported on the handles and fastened to them and to the two cross and parallel pieces in the rear of the wheel. These are so placed as to divide the space at their outer ends equally between them and the first-mentioned stretchers, and fastened to the ends of the handles. Next we have ready a strip of half-inch board, two-and-a-half wide. One end of this is secured to the forward end of one of the front arms, and in like manner to all the others on one side of the machine, and fastened to the handles. Both sides are made alike. The office of these strips is to hold the outside ends of the arms in position; they also hold the front arms from closing. These outside strips also receive the outside edge of the canvas which is fastened to them as well as to the several arms and supports. It will be seen that the wheel is nearly in the centre of the machine. To cover the opening at this point, a frame is raised over it, which is also covered with canvas. The arms or stretchers are so curved that the motion of the machine, in moving from one tree to another, should bring everything falling on the canvas to depressed points, one on each side of the wheel." A bag and broom are carried with the machine, and, as occasion requires, the contents of the stretcher are swept into the bag, which is afterwards dipped into boiling water to kill the inmates. "The whole machine should not exceed ten or eleven feet in breadth, by twelve or thirteen in length. These are for large orchard trees; smaller ones could be protected with a much smaller machine. If the frame work has been properly balanced, the machine will require but little lifting, and will be nearly propelled by its own weight. The curculio catcher or machine is run against the tree three or four times with sufficient force to impart a jarring motion to all its parts. The operator then backs far enough to bring the machine to the centre of the space between the rows, turns round, and in like manner butts the trees in the opposite row. In this way a man may operate on three hundred trees per hour. The frame covering the wheel is made of fine board, while the handles for propelling the machine are riveted *above* the canvas instead of being fastened *below* it, and the Doctor finds that this last arrangement gives him better leverage and greater control of the machine." The machine is, in fact, simply a cotton sheet stretched upon a frame, looking not unlike the wheelbarrows in use upon our public works, only much broader. The side and top views given below will, perhaps, convey a more accurate idea of the form of the catcher than any description. Figs. 58 and 59—c, handles; A, opening to receive the trunk of the tree; B, buffer.

Side view—vertical section.

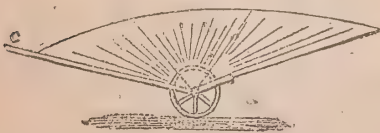


FIG. 58.

Top view.

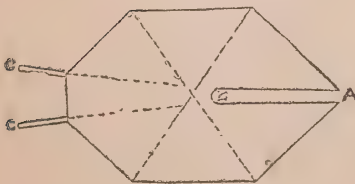


Fig. 59.

An improvement has been made, we believe, on Dr. Hull's machine, by substituting two wheels instead of one, and thus making the draught somewhat easier. The expense, we presume, will be somewhat more, but it is claimed that the advantages secured fully compensate the extra outlay.

There has been considerable discussion as to the best time of day for the jarring process, many persons advocating the latter part of the day, while others, again, insist that the early morning is the better time. The evidence offered on both sides is very strong, but we incline to the view that the morning is the surest time for making a good haul where the jarring can only be given once a day; the oftener, however, the operation can be repeated during the time the curculios are laying their eggs, the more certainty there will be of a good crop of plums.

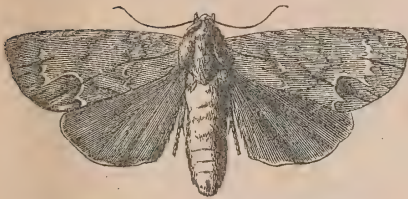
There is yet another remedy against the matured insects which has been proclaimed.

as a great success, and that is to clear the ground for two or three feet around the butt of the tree and lay traps for the curculio, in the shape of sticks, chips, corncobs, stones, shingles, and anything else that will afford a shelter, and then go round at any time in the day, turn the traps over and kill the enemy. Mr. W. B. Ransom, of St. Joseph, Michigan, who is the great advocate of this remedy, states that he killed from seventy-five trees, one thousand six hundred and forty-eight curculios in one hour, while a friend of his, from under two hundred trees, killed two thousand five hundred and fourteen curculios in about two hours. These numbers altogether put in the shade the collection of our fourteen Canadians referred to in the early part of this report. It is evident that our "Cousins" are greater sufferers than ourselves from the ravages of the "Little Turk." The method, though not quite so sure a remedy, we fancy, as Mr. Ransom and his friends appear inclined to believe, is still one that, from its very simplicity, is well worth a fair trial, and we therefore recommend it to our fruit-growers, and shall be glad to hear of any results from its adoption during the next season. In conclusion, we would advise plum-growers to carefully thin out all fruit that is known to contain the grubs of the curculio, and to destroy and burn during the late fall and winter (where practicable) all underbush and rubbish in the orchard, and by these means they will destroy a large number of the insects that would otherwise make their appearance in the spring. It will also be advisable, in forming new orchards, to plant the best kinds of fruit in the centre, leaving the less valuable varieties to be first attacked on the outside, and thus, perhaps, afford better opportunities of waging a persistent war against the wretched little hump-back.

2ND. THE GRAY DAGGER MOTH (*Acronycta Psi*, Linn.).

LEPIDOPTERA, NOCTUIDÆ.

FIG. 60.



Colors—Light grey with black markings.

and it is well that fruit growers should be able to identify their enemies. We are indebted for the following description of the larva to William Saunders, Esq., who has successfully reared the moth.

The body is cylindrical, from one and a quarter to one and a half inches in length, and sparingly covered with whitish hairs, distributed chiefly on the sides, close to the undersurface; the head is rather large and bilobed, black with yellowish dots at the sides and rather flat in front with a few scattered whitish hairs; the body is bluish grey with a slate colored dorsal band, having a central pale orange line from the second to the fifth segments; from the fifth to the eleventh segments inclusive, each segment is ornamented with a beautiful group of spots of which one in front and one behind are bright orange, while one at each side is of a greenish metallic hue, the whole being set in a nearly circular patch of rich black. Adjoining the dorsal band are two lateral cream colored bands, growing indistinct towards the anterior and posterior segments, down which extends on each side from each of the black dorsal spots a short black curved line, having a yellowish dot immediately behind its junction with the dorsal band. The sides are marked more or less with dull ochreous spots, some of which form a broken band close to the undersurface. On the dorsal portion of the twelfth segment is a dull black spot considerably raised. The terminal segment is flattened and blackish. The spiracles are small and black. The undersurface is of a dull greenish color. The feet are black. This is described from several specimens. The larva feeds on thorn, pear, plum and a variety of other trees; it is generally full grown about August when it seeks shelter in the crevices

During the last few seasons the larvæ of this moth have been the cause of much injury to plum trees in the London district, so much so that we deem it worthy of notice, as the moth is tolerably common in most parts of Ontario. It attacks the foliage, feeding upon the leaves and young buds, and thus materially affecting the growth of the tree. We give a description of this moth in all its stages as the larva and pupa are not we believe described elsewhere,

of the bark of a tree or some such suitable place, and there forms a tough silken cocoon, interwoven with the hairs of its body, and therein changes to a chrysalis, in which state it passes the winter, and makes its appearance as a perfect moth about the early part of June. The chrysalis is of a dark shining brown color; is about three-quarters of an inch in length, and ends in a rather obtuse point, which is provided with several hooked bristles. The moth Fig. 60 belongs to the tribe of the Noctuidæ or Owlet moths, so called because they fly only by night; they often bear a strong resemblance to each other, and in several species the only method of distinguishing them rightly is by the larvæ. The sexes of *Acronycta Psi* vary in size, the female being about two inches, while the male is only one and a quarter or one and a half inches. The antennæ are simple and bristle-formed, rather short and of a greyish color somewhat darker on the under side. The front wings of the female are broad and of a pale grey color with various black linear markings; the principal one of which is an irregular cross bearing a strong resemblance to the Greek letter "Psi" placed sideways, and is situated near the anal angle—intermediate between this and the tip of the wing is a much smaller mark of exactly the same shape: the reniform and orbicular spots are preceptible, though somewhat indistinct; a strong black line (thicker in the males than in the females) proceeds from the base of the wing almost to its middle, and emits two or three short lateral spurs: the hind wings are glossy and of a warmer tint of grey—the edges of both front and hind wings have a whitish fringe with an inner border of black spots. The head, thorax and body are grey. The male is smaller, with a narrower body and narrower wings and fringes; the front wings being also of a paler grey and more pointed at the apex.

The larvæ being of a tolerable size when full grown are easily seen and destroyed. Search should also be made for the cocoons during the winter or early spring.

3RD. THE OBLIQUE BANDED LEAF ROLLER (*Lozotenia Rosaceana*, Harris).

LEPIDOPTERA, TORTRICIDÆ.

This moth is a member of a very large family of very little moths that are called, scientifically, Tortrices or Twisters, and popularly, Leaf Rollers, because the larvæ roll up the leaves in which they dwell, and form them into hollow cylinders, disfiguring and destroying them at the same time. Most of these insects, when disturbed, let themselves down to the ground by a fine silken thread. The larva of *Lozotenia Rosaceana* is about half an inch in length; its color is a pale yellowish-green, with three or four black spots about the head and second segment. The body, which is rough to the touch, is covered with minute warts, each of which produces a short almost invisible hair. They attain their full size about June, after which they line the surface of the twisted leaf in which they live with a web of fine silk, and there change into dark brown chrysalids. After the lapse of a few weeks the chrysalis, by means of minute prickles which are placed across the rings of its hinder part, pushes itself half way out of the leaf, and bursting open at the upper end gives egress to the perfect moth.

Dr. Harris thus describes the moth:—"The forewings are very much arched on their outer edge, and curve in the contrary direction at the tip like a little hook or short tail. They are of a light cinnamon-brown color, crossed with little wavy darker brown lines; and with three broad oblique dark brown bands, whereof one covers the base of the wing and is oftentimes indistinct or wanting; the second crosses the middle of the wing, and the third, which is broad on the front edge and narrow behind, is near the outer hind margin of the wing. The hind-wings are ochreous-yellow, with the folded part next to the body blackish. It expands one inch or a little more." The larva when disturbed escapes by its silken thread, and being very active often eludes capture.

Its depredations are sometimes very serious, more especially as the insect appears to select the terminal branches of the tree, and thus effectually checks its growth. Whenever practicable, the curled and twisted clusters of leaves should be picked and crushed; it has also been suggested to thoroughly drench the trees with a mixture consisting of a pound of whale oil soap in seven or eight gallons of water, and thus destroy the caterpillars hidden in the leaves; a weak solution of carbolic acid is also recommended.

4TH. THE EYE-SPOTTED BUD MOTH (*Grapholitha oculana*).

LEPIDOPTERA, TORTRICIDÆ.

This moth is a member of the same family as the one last described. The chief peculiarity of the larva consists in its selecting the opening bud for its attack. The caterpillar is a small cylindrical naked worm, about three-quarters of an inch in length, of a pale, dull, brownish color, with small warts from which arise fine short hairs; the head and the top of the next segment being black. Its *modus operandi* is thus described by W. Saunders, who found it depredating his plum orchard:—"Its tenement consists of a dried-up blackened leaf, portions of which are drawn

FIG. 61.



together so as to make a rude case, the centre part of which, where his highness resides, is lined with silk. It is very fond of going just where you do not want it. It is partial to the blossoms and newly formed fruit. If you have a new pear or plum fruiting with a single bunch of blossoms on it, which you are anxiously watching, by-and-bye you find that several of the blossoms have set, and while you are flattering yourself that they are doing well, along comes the mischief-maker, pitches his tent alongside this very spot, and drawing the young fruit together with silken threads, holds high carnival among them and frustrates your hopes. Another of its tricks is to gnaw a hole into the top of the branch from which your bunch of blossoms issues, and tunnelling it down, causes the whole thing to wither and die. Often it contents itself with damaging the leaves only, and this one does not mind so much, drawing one after another around its small inside case until it forms quite a little bed of withered and blackened leaves. The moth, which expands about half an inch, is of dark ash-grey color. The fore wings having a paler whitish-grey band across the middle; there are two small eye-like spots on each of them, one near the tip being composed of four little black marks placed close together in a row, on a light brown ground, the inner marks being longer than the others; the second eye-spot is near the inner hind angle, and is formed by three minute black spots arranged in a triangle, in the middle of which there is sometimes a black dot. The hind wings are dusky-brown." Mr. Packard describes it as having been generally injurious in Essex County, Mass., in 1869, especially on the apple, cherry and pear; and during the past two seasons it has committed havoc among the plum trees in this (London) district.

Similar remedies to those described in the last-mentioned insect should be applied, hand-picking being the most preferable.

The codling moth, and various other kinds of insects may be found occasionally to affect the plum; it is, therefore, indispensable that fruit-growers, to be successful, should keep a watchful eye over all their trees, and endeavor, by patience and perseverance, to maintain the upper hand of these destructive foes. "Eternal vigilance" is the price of success in fruit-growing, as in all other undertakings.

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